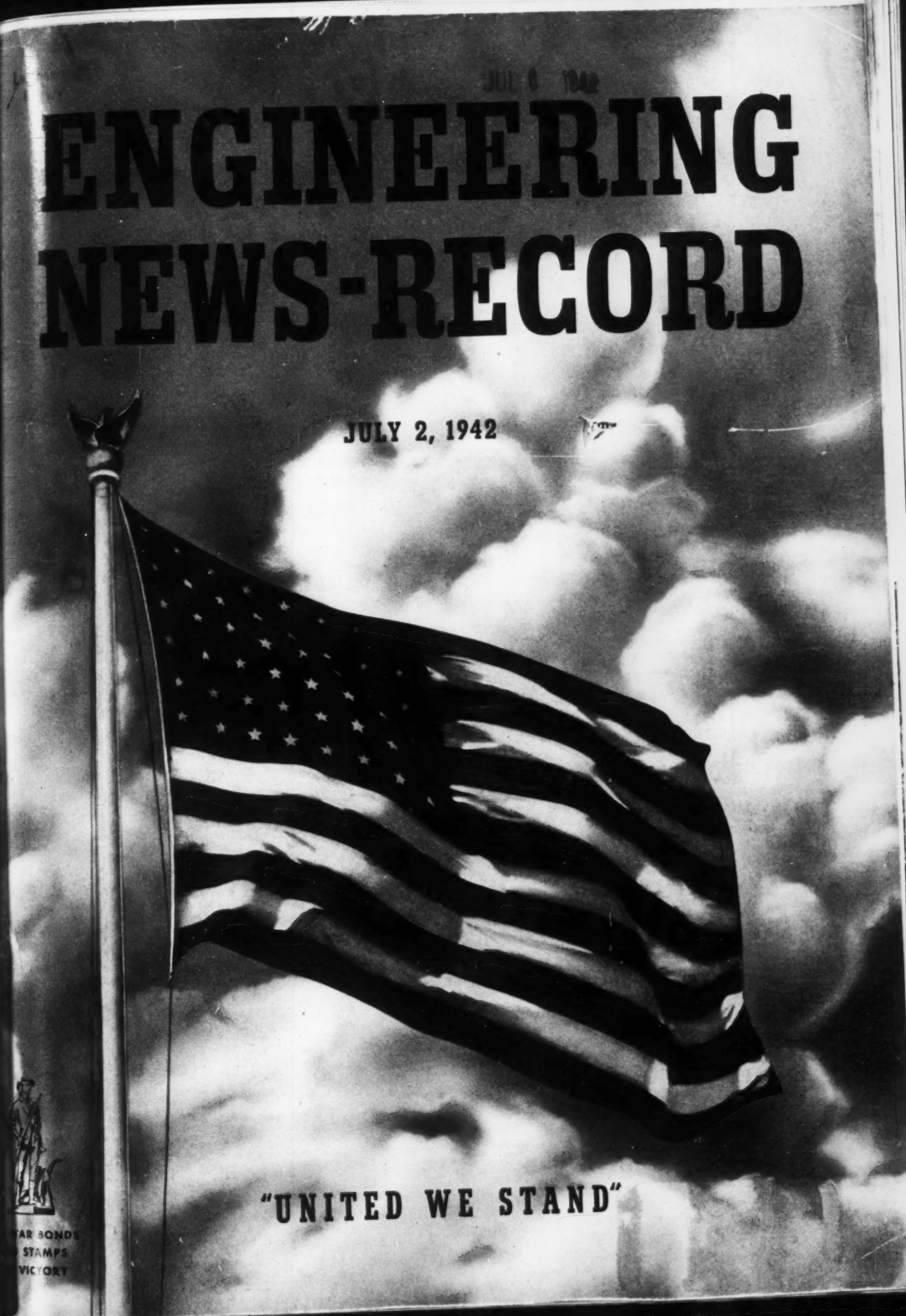
ENGINEERING NEWS-RECORD

JULY 2, 1942



"UNITED WE STAND"

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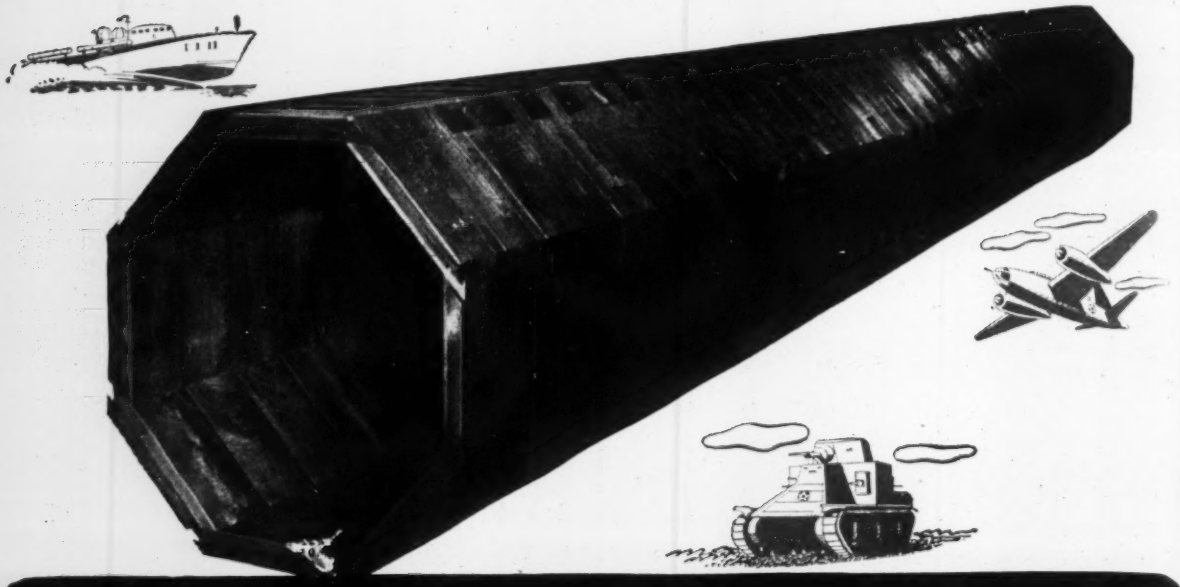
STAMPS
VICTORY



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Steel, a critical war material, must not be used in any drainage structure except where engineering integrity demands it. Yet here is a practical war-time substitute. It's the new ARMCO Emergency Pipe, designed by a drainage engineering organization with 38 years' experience.

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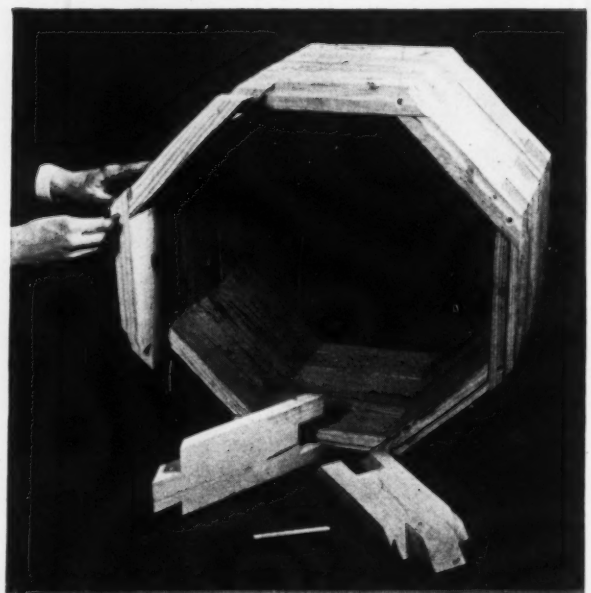

The patented Emergency Pipe design utilizes short wood sections to impart beam strength and wood dowels to eliminate nails.

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ENGINEERING NEWS-RECORD

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McGRAW-HILL PUBLISHING COMPANY, INC.

Publication Office: 99-129 North Broadway, Albany, N. Y. • Editorial and Executive Offices: 330 West 42nd Street, New York

JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

Vol. 129 JULY 2, 1942 No. 1

COMING NEXT

• Building 10,500-ton Liberty ships in 46 days! Here is a story that tells of the ingenuity of American engineers in licking one of the greatest problems ever faced by the United States. For the first time traditional practices of the construction industry are being applied to shipbuilding on a mass production scale.

• War Housing for Peacetime Use —an article that points the way to sound community planning, attractive design, and durable construction, all within a price range the average home seeker can afford.

• How to overcome the problems resulting from a shortage of reinforcing steel bars by applying scientific methods to the designing of plain concrete footings for columns and walls.

LOOKING AHEAD

• A sewage disposal plant that can be operated with almost any combination of units to produce a varying degree of treatment—or a fixed degree of treatment regardless of flow variations, is a wide departure from conventional practice. But the conditions that demanded such flexibility were far from conventional—an army camp where the population might vary from 3,500 to 35,000 over a period of days. The War Department has sanctioned publication of the design features of this unusual plant.

• Camouflage for industrial plants is receiving more and more attention as it is realized that operations vital to the nation's war effort may be subject to air attack, especially those in exposed locations along the coasts. An article to be published in the near future will tell of the types of camouflage considered by the Army Engineers to be best suited to conditions in this country and will outline the possibilities and limitations on that type of protective concealment.

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Congress all set to forbid more cost-plus contracts

Findings of house and senate investigating committees to form basis for legislation. War Department expected to oppose move curtailing Army's power

Members of Congress shortly will attempt for the second time in two years, to enact legislation that will prohibit any further cost-plus-fixed-fee contract letting by the Army.

The move is aimed directly at construction contracts—both for war plant and for construction of military posts—and apparently is an outgrowth of a report issued last week by the Senate's Truman Committee and another by the House Military Affairs Committee, which sharply criticized the contract-letting procedure.

Any such measure will almost certainly face strong opposition from the Corps of Engineers, as it did a year ago when legislation with a similar objective was attached to a money bill as a rider. At that time both Maj. Gen. Eugene Reybold, Chief of Engineers, and Lt. Gen. Brehon B. Somervell, then in charge of construction for the Quartermaster Corps, appeared before the congressional committees to oppose curtailment of the Army's power to let this type of contract.

Army objections

Such legislation would be opposed on the ground that it would seriously hamper efforts to meet the fast-changing war picture, by removing the present flexibility of the construction program. The number of cost-plus-fixed-fee contracts let over the past few months has shown a consistently downward spiral as the Army has shifted to its Architect-Engineer-Manager program (*ENR*, Feb. 19, p. 297), and as the biggest demand for war plant and army facility construction is met. But to allow for the possibility of a greater expansion of troops in training or service, expansion of the air or other services, or need for new types of equipment that might require new plant, the Army wants to keep this method of letting contracts as an active tool in its workshop.

Army construction men are quick to admit that there are numerous instances where investigation will show costs higher than should have been necessary had there been opportunity for careful planning. Some of the jobs built admittedly ran far above the original cost estimates. In fact, there are few who will say they have any love for the cost-plus-fixed fee method as a regular way of doing business.

But against this list of bad effects (and there are more not mentioned) is the unassailable fact that the work was done, done fast, and reasonably well.

A little history

Almost simultaneously with the signing of the Selective Service Act, the Corps of Engineers and the Quartermaster Corps were given funds to build camps to house the army to come. With a small engineering staff that allowed of practically no field force, with very little in the way of advance planning at hand, and bound by procedure that dictated lump-sum, competitive bidding, the job became almost impossibly big. Finally, early in 1941, the "cost-plus" method was adopted. Despite its faults, "cost-plus" made possible rapid letting of contracts, some on jobs where the architects and engineers were literally only one jump ahead of the construction crews. It permitted needed and often sudden changes in plan without necessitating the lengthy process of re-letting contracts or re-negotiating items. It made it possible to demand overtime and general speed-up which would have been difficult had the contractor made a fixed bid, based on a pre-determined estimate of labor costs.

Admittedly, again, many of the jobs ran far ahead of original estimates when completed. But it is not felt that this was the fault of contractors or of the engineers. It was rather the fault of a war situation changing so rapidly that last month's estimates are virtually dead letters this month. One camp, estimated to cost about $900,000, eventually cost nearly $25,000,000. But it was originally planned to house 1500 men, now houses more than 28,000; accommodating 20 times the originally estimated personnel, it cost less than 28 times the original estimate. By and large, costs have not been greatly in excess of what they should have been, in view of actual construction conditions.

In construction of war plants, the same situation obtained. At the start of the defense effort, there was small store of knowledge in this country of exactly what the total requirements would be, let alone actual engineering plans for such plants on the huge scale that developed as the effort intensified.

One criticism levelled at the system has been that there is no incentive in a cost-plus-fixed-fee contract for economy on the part of the contractor. On the other hand, neither is there any incentive for extravagance, since the fee can only be raised after negotiation, and that only after a change in plans necessitates additional work.

The Army has been strict in its dealings with contractors asking more money. Fees have averaged about three percent

(*Continued on page 54*)

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War demands "milking" engineer world dry

The great demands of expanding Army activity on the services of the Corps of Engineers have forced the Corps to "milk" the civil engineering profession "almost dry," Maj. Gen. Eugene Reybold, Chief of Engineers, said last week.

Testifying before the House Military Appropriations Committee, Gen. Reybold said his organization now has charge or supervision over nearly 50 percent of all construction in the United States. In order to meet the need for trained personnel for this work, the Corps has been forced to commission men directly from civilian life, as well as draw on construction workers, men who have had engineering training but did not complete their courses, and even train some men "from scratch," to fill the need.

"To make a long story short," Gen. Reybold said, "we are milking the engineer world almost dry on personnel."

of the total contract—half of the figure authorized by Congress when it granted permission to use the procedure. The character of the work, too, has generally been surprisingly good, in view of the difficulties imposed by often hastily-selected sites and rapid changes in overall plan.

In short, although it is felt that "cost-plus" has not been an overall financial success, it was a tremendous boost to the nation in its race against time. It did produce the plant and the facilities. Best proof is that there was an army in training, and an armament industry in operation, when Pearl Harbor shoved America into the war.

• • •

Corps of Engineers gets nearly four billion more

In approving the $42,820,003,067 appropriation for the War Department last week, the House of Representatives assigned $3,312,545,192 to the Corps of Engineers to cover all activities for the fiscal year ending June 30, 1943.

The figure represented a drop of $5,032,265,341 under the 1942 appropriations, although it was nearly $400,000 greater than had been set in 1943 budget estimates.

Most of the decrease in appropriation for the Engineers was accounted for in funds set aside for construction of military posts and defense installations, for which $2,089,168,000 was appropriated. In 1942, for the same purpose, the Corps received more than seven billion dollars.

Funds for additional construction of barracks and quarters were set at $341,042,000—an increase of $114,231,917 over 1942, to provide additional accommodations for an army expected to reach 4,500,000 men by the end of the year.

Other specific appropriations set-up in the bill included:

Engineer service—design, development and maintenance, $874,132,192; construction and repair of hospitals, $8,203,000.

• • •

Cost jumps $15,000,000 on War Dept. building

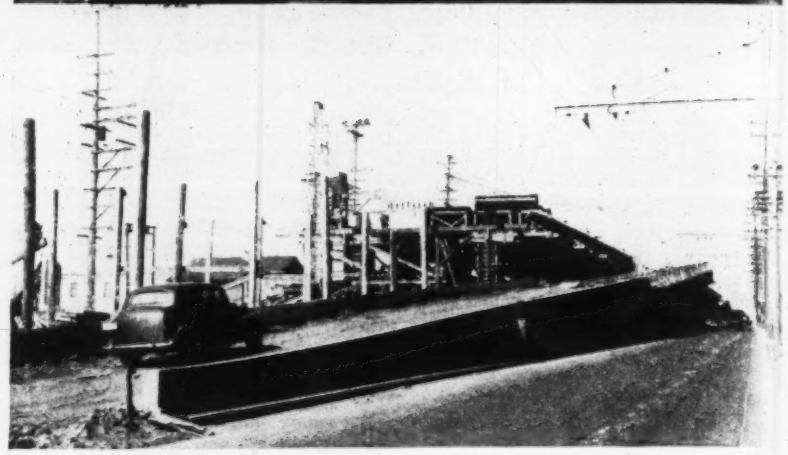
Due to changes in site and plans, the new War Department Office Building at Arlington, Va., will cost about $50,000,000, or about $15,000,000 more than was originally estimated.

According to testimony before the House Military Appropriations committee last week, the building as now being rushed towards completion (*ENR* June 4, p. 920) will contain about 4,000,000 sq. ft. of floor space, of which 2,600,000 sq. ft. will be available for office space, and the remainder for storage space, cafeterias and utilities. It will house between 25 and 30,000 workers.

As first planned, the structure was to contain a total of 3,000,000 sq. ft. of space, and cost about $35,000,000.

A million and a half sq. ft. are now occupied, the remainder to be made available in sections as completed until the entire building is ready, sometime in the early fall.

Maj. Gen. Eugene Reybold, Chief of Engineers, told House committeemen during the hearing that the new building would be "unique in Washington" in that it would embody practically no outside embellishment, no fountains or other non-essential landscaping, and that general landscaping will be held to a minimum.



Designed to relieve Seattle's traffic congestion

Designed to relieve traffic congestion on one of Seattle's most heavily traveled streets in the industrial district, the $1,000,000 Spokane Street viaduct is well under construction, although work is hampered by the scarcity of steel. The above views show the reinforced concrete viaduct, with typical traffic congestion, and one of the ramps leading up to the main structure.

Difficulties faced by the contractor include working in cramped quarters, with constant traffic on both sides and the presence of soft sand soil conditions.

The upper picture is taken at Colorado Ave., where a steel span would carry traffic across railroad tracks to the viaduct. If steel were secured for this span and for another similar span at East Marginal way, the viaduct could be put into service between First Ave. S. and Sixth Ave. S. within 60 days, according to R. M. Murray, resident engineer for the state highway department. Spokane Street carries traffic to several defense plants over a number of railroad tracks which seriously interfere with automobile traffic. The viaduct contract is held by MacRae Brothers, Seattle.

Senate rejects proposal for Alaska Road probe

The Senate Foreign Relations Committee has unanimously rejected a resolution by Senator Langer of North Dakota calling for an investigation of the choice of an inland or "prairie" route for the road now being constructed across Canada to Alaska.

Senator Connally, committee chairman, said that since the road had been chosen and work started the project should be completed regardless of what ultimately is done about other routes leading to the Alaska territory.

Water utility service faces severe curtailments, AWWA conference hears

Service extensions prohibited and water use restrictions being considered, Krug of WPB tells American Water Works Association

Smashing any hopes that water utility service might be maintained on accepted high standards of perfection, J. A. Krug, chief of the Power Branch, Conservation Section, War Production Board, told the American Water Works Association that after July 1 no new service connections could be made to dwellings, and that study was being given to restricting water consumption. He also pointed out that unusually high inventories of materials now being carried by some water utilities may have to be pooled because demands far exceed available supplies.

These revelations came at the close of 62nd annual meeting of the association, held in Chicago, June 21-25. The conference, which was devoted to wartime waterworks problems, drew an attendance of 1,438. Registration was virtually as high as that at previous peacetime meetings.

The new order of the WPB, prohibiting any service connections to dwellings for which foundations were not in place by July 1 (only exception is certain war housing projects), supersedes a March 26 order that permitted service extensions up to a length of 250 ft. Even war housing schemes are under close scrutiny, and it was indicated that on some projects it may be necessary to resort to the installation of central bathing, sanitation and cooking facilities, thus eliminating the need for distribution mains and plumbing fixtures.

Water use may be arbitrarily restricted in some places, said Mr. Krug, where consumption demands have created the need for expansion of existing plant facilities. If restrictions are ordered, they would apply first to non-essential uses, such as air conditioning and lawn sprinkling.

Materials simply not available

Mr. Krug's convincing analysis of war needs and materials shortages made it clear that despite the vitalness of water service, it, too, must be adjusted to the "desperate" tempo of the times. He made these recommendations to the waterworks industry:

1. Provide adequate water—but no excess.

2. Concentrate on the use of substitutes. There is no hope for any improvement in the shortages of basic materials this year or in 1943.

3. Re-evaluate standards and specifications; all designs must be made with a view toward reducing use of critical materials. In this connection Mr. Krug cited the possibility of using wood stave pipe for distribution main extensions.

4. Revise repair and maintenance program, deferring even such work as might incur risks or the taking of chances that ordinarily would not be tolerated.

Must live off "fat"

Of considerable concern to the War Production Board, said Mr. Krug, was the large inventory of waterworks supplies now on hand. Most of the systems, he reported, have a two-year inventory, and some way must be devised for water utilities to "live off this accumulated layer of fat."

On the basis of a survey of 40 percent of the water systems in the country, it was revealed that in the first quarter of 1942 waterworks had an inventory of parts and supplies amounting to $16,500,000, as compared with only $14,900,000 in the same period of 1940. Furthermore, the surveys reveal that much more material is being bought than is used. For example, in the first quarter of the year some $4,250,000 of cast iron pipe was purchased, but only $500,000 worth was used; and $402,000 of copper and bronze were bought but only $68,000 worth used.

These and other equally high surpluses must be drawn upon, warned Mr. Krug, reminding his listeners that the law provides that one utility can place orders against the inventories of another utility if material otherwise is unavailable. If this plan does not work on a voluntary basis, a general mandatory "pooling" scheme will be inaugurated.

It was urged that all orders be cancelled for material not immediately needed, and even for material necessary to continue so-called "normal" service. "Our present desperate situation with regard to materials," concluded Mr. Krug, "calls for unusual sacrifices, and the waterworks industry is called upon to make sacrifices greater, perhaps, than other industries."

Conference termed a success

Harry Jordan, secretary of the association, termed the conference a huge success in providing information on current war problems. One of the special features was a "priorities clinic," where experts were available to answer questions on all phases of material procurement.

Mr. Jordan revealed that total membership now was 4,386, an all-time high. Next year's conference is scheduled to be held in Cleveland, probably during the week of June 14.

Papers at the conference dealt with air raid precautions, sabotage precautions, conservation of critical materials and administrative problems relating to priorities and personnel. Abstracts of a number of the papers will be published in the July 16 issue.

Succeeding Louis R. Howson as president was Abel Wolman, professor of sanitary engineering at The Johns Hopkins University. Professor Wolman's appointment as special consultant to the War Production Board on water supply was announced at the meeting. Samuel B. Morris, dean of engineering at Stanford University, took office as vice president.

New members of the association's board of directors, elected by local sections, were: John F. Longwell, California; H. S. Thane, Montana; W. W. Morehouse, Ohio; I. M. Glace, Pennsylvania; H. H. Hyman, Florida; C. M. Calvet, Cuba; E. W. Johnson, Minnesota; Thomas L. Amiss, Louisiana; and W. W. DeBerard, Illinois.

Exhibits stress service

The waterworks show, in which 79 manufacturers participated under the general direction of Arthur Clark, manager of the Water and Sewage Works Manufacturers Association, was devoted largely to displays featuring service and maintenance aids as well as equipment designed for emergency use in air raids. The latter included mobile and portable sterilizing machines, pipe repair appurtenances and other aids designed to facilitate repairs.

New officers elected by the Manufacturers Association were: president, D. F. McAfee, The Door Company, Inc.; vice president, C. A. McGinnis, Johns-Manville Co.; and treasurer, Edgar Buttenheim, American City Magazine Publishing Corp.

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Army spending a billion on Southwest projects

Speaking before a recent meeting of the Dallas Technical Club, Col. S. L. Scott, Corps of Engineers, stated that more than one billion dollars is being spent in the Southwest by the Army alone. Already completed or under way are 300 projects which, according to Col. Scott, places the Southwest Division of the Corps of Engineers ahead of any other division in the United States as to the number of jobs completed or under way and in the amount of money being spent. Colonel Scott paid high tribute to the construction industry—engineers, architects and contractors—for its part in the work. Much of the construction has been accomplished without the use of basic materials now on the critical list.

A.S.T.M. annual meeting reflects vast changes in materials

Annual convention emphasizes specifications for war materials and brings out discussions of test procedures and research connected with their development. Fifty emergency alternate specifications

As has been common practice in the past, this year's annual meeting, the forty-fifth, of the American Society for Testing Materials, held in Atlantic City, N. J., June 22-26, 1942, was built around a program involving presentation of over 100 technical papers and specification and test committee reports. Unlike most previous meetings, construction materials did not rate foremost attention, this being reserved for what might be termed "production" materials and particularly alloy steels such as are required in ordnance and aircraft. Special features of the program were a round table discussion of alternate alloy steels including the conservation of strategic alloys and a three-session symposium on developments in radiography inspection and testing. Despite the emphasis on "production" materials, however, construction materials did not suffer from lack of attention, developments being recorded in respect to welding wire, reinforcing bars, welded and seamless pipe piles, cement, brick and concrete. Attendance at the convention approximated 1400, second only to the record year of 1940 when 1,440 were present.

The new president of A.S.T.M. is H. J. Ball, professor of textile engineering at Lowell Textile Institute, while P. H. Bates, chief, clay and silicates products division, National Bureau of Standards, was elected vice president. Feature speakers at the general sessions included Brig. Gen. C. D. Young, director of procurement and distribution S.O.S. U. S. Army; retiring president G. E. F. Lundell, chief, chemistry division, National Bureau of Standards; and Graham Edgar, director of research, Ethyl Gasoline Corp. who delivered the annual Edgar Marburg Lecture on the subject of Gasoline—Past, Present and Future. Although he decried the lack of a "standard crystal-gazing ball" Mr. Edgar nevertheless predicted that ordinary grade gasoline after the war would have an octane number in the neighborhood of 80 while premium gasoline would rate upwards of 90 to 100; furthermore that the automobile industry would develop cars to use such gas with unprecedented efficiency.

In presenting the report of the executive committee, C. L. Warwick, secretary-treasurer of A.S.T.M., emphasized the substantial contributions the society is making to the war effort both in research and specifications. To date, nearly 50 emergency alternate specifications have been drawn by a rapid short-cut procedure that puts them into use in minimum time; 19 of these are in the field of steel and of iron-chromium-nickel alloys. Mr. Warwick, himself, is serving as chief of the specifications branch, bureau of industrial conservation, War Production Board.

General materials developments

As stated, the symposium on radiography was an outstanding feature of the meeting, and developments in this field are bringing it ever closer to the civil engineer's interest. Inspection by X-rays and gamma rays is assuring good quality in turbine castings, in pipe and in weldments of all types, and interesting recent advances include an exposure meter for X-ray radiography developed at the Naval Research Laboratory and a million volt "portable" X-ray unit developed by the General Electric Co.

Alloy steels for ordnance and aircraft use are undergoing constant transformation as scarcities develop in the various alloying elements. Copper has practically been eliminated from all steels. Attempts are being made to eliminate manganese from less essential steels so that its use may be increased in "war" steels, where in some instances it can take the place of nickel and chromium. Much nickel, chromium and molybdenum is being reclaimed from scrap and used in the special "national emergency" steels, which effects further conservation. Stainless steel is finding increasing use in aircraft to replace aluminum. A permanent benefit from the conservation activity in alloys is the development of "lean" alloy steels that are even better than some of the conventional "rich" compositions. It is also possible that the unduly large number of compositions available before the war may be permanently reduced.

Plastics command increasing attention at each A.S.T.M. meeting. Great masses of test data are being accumulated, and a rich background is being prepared for the more extended use of plastics. One paper at this year's meeting reported a "mar resistance" test. As reported by Ladislav Boor (American Cyanamid Co.), it involves allowing an abrasive to fall against the surface and measuring the loss in gloss by an optical instrument. It is advanced as a "hardness" test for plastics. Another paper by John Delmonte, Plastics Industries Textile Institute, presented data on the acid and alkali resistance of a large number of plastics; a punch test was developed to be used, after immersion of a plastic in an acid or alkali bath, that gives a good indication of comparative physical property losses.

In the field of bituminous materials, specification work was active, but only one research project was reported this relating to a rapid method of estimating ring-and-ball softening points of asphalts, developed by A. B. Hersberger and C. Overbeck of the Atlantic Refining Co. It is based on the time required for the asphalt in the ring and ball apparatus to flow 1 in. when immersed in a constant temperature bath. Total time required is 10 min. against 90 min. for the standard method. Committee D-4 on road and paving materials presented new tentative specifications for sodium chloride and for slow-setting emulsified asphalts as well as a volume correction table for tar and coal tar pitch. The committee also reinstated the Deval rattler specification as a companion to the one covering the Los Angeles machine. Committee D-8 on bituminous waterproofing and roofing materials presented new tentative standards for coal tar pitch for steep built-up roofs and for asphalt-saturated-and-coated asbestos felt for roofing.

Steel

Committee A-1 on steel, largest and one of the oldest Society committees, recorded one of its busiest years in a report for whose clarity, orderliness and completeness R. J. Painter of the Society's staff was accorded high praise by N. L. Mochel, chairman and the membership generally. Among actions of import to the construction industry are the adoption of tentative specifications for arc welding electrodes; for gas welding electrodes; and for welded and seamless steel pipe piles. The revised arc welding electrode specifications include the addition of yield strengths for classes E60 and E70 and of all mechanical data for classes E80, E90 and E100. Root and face bend tests are also described. The gas welded electrodes covered are suitable for carbon and low-alloy steels. In the pipe pile specification an important feature is a table of standard weights and dimensions. Among the outstanding emergency alternate specifications is one covering axle steel reinforcing bars. Committee A-1 has 16 technical advisory committees working on emergency alternate specifications for as many different products.

Two significant papers were presented at the steel session, one on wire, the other on Bessemer cast steel. In reporting an investigation of the effect of various drawing procedures on physical

What the first bucket of concrete started at Friant Dam in California

Extending for about two-thirds of a mile between the hill crest on either side of the San Joaquin River, near Fresno, Calif., Friant Dam stands today virtually complete. The final cubic yard of concrete was placed in the mammoth structure of the Central Valley Project on June 16, just short of two years from the time the first concrete was poured (as shown in the illustration at left), on July 29, 1940.

With a total of 2,130,480 cu.yd., Friant becomes the fourth largest concrete dam.

Built for the U. S. Bureau of Reclamation, it will soon begin serving its function in the control of floods originating on the upper reaches of the San Joaquin River and creating of a water reservoir for providing supplemental irrigation to thousands of acres of land in Madera, Fresno, Culare, Kern and King counties.

Although the big job of placing concrete has been completed, there is still work to be done, which includes installation of the spillway gates and control valves, painting of metal work, backfill and clean-up operations, and drilling of grout holes in the foundation, which is expected to continue for several months.

The construction contract is held by the Griffith Company, and Bent Company.

properties of cold-drawn wire, Howard J. Godfrey, John A. Roebling's Sons Co., revealed that higher tensile strengths go with large reduction in area per draft; that rate of drawing has no consistent effect on torsional properties; and that a low rate of drawing improves elongation slightly. What was held to be one of the most important elements of the investigation was the development of a bend test apparatus that gave consistent results and showed that toughness of steel wire may be measured by the number of bends to cause fracture, taking into account also the appearance of the fracture. For the wire tested (0.220 in dia. and of 0.67 carbon and 0.27 carbon) a 75 to 80 per cent total reduction in area by drawing was indicated as best. L. M. Winkler, Bethlehem Steel Co., pointed out that for smaller wire a greater reduction in area may be found to be the optimum.

The significance of the Bessemer cast steel study presented by C. E. Sims of Battelle Memorial Institute was that it showed that properly made Bessemer steel is not an inferior product. The paper concluded that "mechanical or engineering properties of all the steels investigated were governed by composition and deoxidation rather than by melting process." And that "with proper deoxidation all the processes can make steel of the quality demanded for war purposes."

Cement

In the cement field the convention development of most widespread interest did not appear on the program. This was the announcement of the completion and issuance of emergency alternate (EA) specifications for portland cement, being in effect a revision for the duration of specifications C-150. At least that will be the effect when the War Production Board issues a limitation order applying to cement; and it is felt that such an order is not far off since it was WPB that requested the cement specifications.

ASTM specification EA-C150 covers only cement types I (general purpose) II (moderate heat) and III (high early strength), omitting types IV and V. It also changes some of the requirements of the cements covered, partly to bring them into line with federal cement specifications 191, 206 and 201 and partly to meet WPB's desire to conserve materials and power in the manufacture of cement. With respect to the latter for example, the cement industry is said to use 30,000 tons of steel annually, a large part of which goes into grinding machinery; the EA specifications puts a maximum fineness limit of 2000 sq. cm. per gr. on Types I and II, thus reducing grinding and power consumption. A second provision based on the conservation philosophy is to raise permissible autoclave expansion from ½ to 1 percent. Other features of the EA specification are deletion of the 28-day test requirement, and use of a 3- and 7-day tension test only; permission to use TDA as an addition in all three types and vinsol resin in types I and II, and reduction of some of the chemical requirements. It is expected that the WPB limitation order, when it is issued, will name several specific jobs on which "special" cements can be used, but that otherwise Types I, II and III, modified in accordance with the EA provisions, will be all that will be manufactured for the duration. The EA specifications were developed by a committee headed by J. L. Miner, Atlas-Lumnite Cement Corp.

Committee C-1 on cement presented several revisions in the chemical analysis specification, but otherwise was not active in specification work. Another try at a specification for blended cements did not get out of committee. Important research studies on alkali in cement, on "treated" cements containing additions, and on the use of an air permeability measurement method to supplement the turbidimeter method in fineness determinations are underway.

(*turn to page 58*)

Among the cement papers presented was one by Prof. Alfred H. White and Harold S. Kemp, University of Michigan, bringing up to date information on volume changes of bars, first measured 40 years ago. All the bars show progressive expansion when alternated between air and water, resulting in the conclusion that the only remedy lies in keeping concrete in an environment where moisture content is relatively constant. However, both Prof. White and F. O. Anderegg, who discussed the paper, agreed that modern cements would probably not show expansion tendencies for so long since they are more finely ground, which speeds up complete hydration.

Mortar and brick

Several papers reported mortar studies. Paul S. Roller, U. S. Bureau of Mines, described some tests for plasticity in which he presented results in a series of load-deformation curves; mortars giving smooth curves are held to be workable; those whose curves flatten out or drop sharply before the desired load has been applied are generally unsatisfactory. Prof. Howard R. Staley, Massachusetts Institute of Technology, reported tests with 14 curing methods for lime-cement mortars, the best using a converted refrigerator with the back wall consisting of a saturated burlap blanket; and with 4 curing methods for straight lime mortars for which exposure to laboratory air is best. F. O. Anderegg, consultant of Pittsburgh, described a study of the effect of brick absorption characteristics on mortar properties: bricks of intermediate absorption are not only easiest to lay but give by far the highest bond and mortar strengths. The importance of rate of absorption was officially recognized by the convention in adopting a test method for determining "the initial rate of absorption," to be included among the standard methods for testing and sampling brick. Essentially it involves determining the gain in weight of a dry brick inserted ⅛ in. into a tray of water for 1 min.

Durability of soft-mud building brick under various tests was reported by John W. McBurney, National Bureau of Standards. ASTM procedure for separating durable from non-durable bricks is based on 50 cycles of freezing and thawing, but Mr. McBurney carried his tests to 175 cycles. Out of 50 brick, 15 failed by 50 cycles whereas 125 cycles more caused an additional 23 failures. It was concluded that a more severe test than 50 cycles is required if freezing and thawing is to be used as an acceptance test of brick in lieu of determining physical properties.

Concrete

Both specification and research developments were recorded in the field of concrete. A new tentative specification for waterproof paper for curing concrete was adopted, as were tentative methods of sampling fresh concrete, of measuring the length of drilled concrete cores and of determining air content of freshly mixed concrete, the last named being particularly significant in view of the increasing use of additions and admixtures that entrain air in concrete. The tentative specifications for ready-mixed concrete, which were to have been advanced to standard status, were continued as tentative partly because of a generally recognized inadequacy in the definition of ready-mixed concrete.

Four different research projects formed the subject of as many papers. Reporting comparative results of freezing and thawing tests of aggregates and of concrete beams in which the same aggregates were used H. H. Munger, Kansas State College, concluded that there is no correlation between the two and that durability tests should be made on concrete mixed in the proportions to be used in the field; furthermore, that field service records should be given greater weight than laboratory tests in acceptance or rejection of aggregates. H. S. Mattimore, Pennsylvania Highway Department, objected to such sweeping conclusions on the ground that laboratory tests do provide much information useful in predicting or explaining field results.

What is believed to be the first tests yet made of the reflectivity of white portland cement concretes were reported by C. W. Muhlenbruck and E. H. Miller, Carnegie Institute of Technology. Neat cement specimens reached a maximum reflectivity of 82 percent in 15 days. Adding 4 parts of white sand reduced the reflectivity to 70 percent, while river sand permitted only 40 percent reflectivity. Better reflectivity results from a high water-cement ratio concrete, and trowel-finished concrete is 20 percentage points higher than concrete cast against a paraffined mold. Wetting white concrete reduces its reflectivity 19 percentage points. The tests also indicated that atmospheric exposure substantially reduces reflectivity as does also severe freezing and thawing.

Interesting data respecting factors to be applied to compressive strengths of concrete test specimens in which the h/d ratio is other than 2.0 were reported by James W. Johnson, Iowa State Highway Commission. Good agreement with the standard A.S.T.M. factors was found for all ratios except 1.0. A smaller than standard factor was indicated when h/d equals 1.0.

The fourth research project, reported by Roy W. Carlson, Massachusetts Institute of Technology, involved the use of powdered aluminum as an admixture in concrete. The familiar action of aluminum in concrete is to release hydrogen gas and thereby produce a light weight product. Recognizing that the use of substantial amounts of aluminum also greatly reduce concrete strengths, Prof. Carlson tried using only about .01 percent. The results were spectacular in improving both bond and flexural strengths while reducing compressive strength very little (and not at all in harsh and lean mixes). If some bond and flexural strength can be sacrificed, additional aluminum powder can be used to increase resistance to freezing and thawing.

An important item of business at the concrete session each year is the presentation of the Sanford E. Thompson Award. This year it went to John Tucker, Jr., chief, concreting materials section, National Bureau of Standards for his paper "Statistical Theory of the Effect of Dimensions and of Method of Loading Upon the Modulus of Rupture of Beams." A feature of this year's award was that it was presented by Mr. Thompson himself, whose substantial contributions to concrete research caused the award to be named in his honor.

Railway to supplement Alaska road considered

The Army is considering construction of a railroad to supplement the Alaska highway, as a means of bolstering pay-load capacities of trucks that will be using the road next winter.

Testifying before a House committee last week, Lt. Gen. Brehon B. Somervell, Chief of Supply, said the Army hopes to have four routes to Alaska—by sea, by air, by road, and perhaps by railroad.

Speaking in support of a request for appropriations to cover survey costs for such a rail line, Gen. Somervell said:

"The trucks, of course, require a tremendous amount of gasoline. In other words, their pay-load over such long distances would be relatively small. We feel that if the effort up there is to be of any size, the highway will have to be supplied by railroad."

Tacoma Narrows Bridge collapse cost $2,216,746

Collapse of the Tacoma Narrows suspension bridge caused a loss of $2,216,746, it was revealed last week following an audit of the Washington State Toll Bridge Authority by State Auditor Cliff Yelle.

Cost of the bridge was listed at $6,423,079 (of which 45 per cent was a PWA grant), the amount of insurance received was four million dollars, and salvage value was listed as $206,333, bringing the total to $4,206,333, thus leaving a balance of $2,216,746 as the amount lost due to the accident.

Bonds outstanding amounting to $3,750,000 were redeemed from proceeds of the insurance, and the premium paid on the bonds retired amounted to $146,000. The amount of interest paid on bonds retired during 1941 was $175,781.

Educators told of engineer shortage

A growing shortage of engineers was reported to the 50th annual meeting of the Society for the Promotion of Engineering Education by William L. Batt, director of materials, War Production Board, and Karl T. Compton, president of Massachusetts Institute of Technology. The need is felt in both war industries and in the research program aimed to speed the nation's war effort.

The 50th annual meeting of the society, originally scheduled for the week of June 29–July 2, was streamlined into a week-end meeting so that college facilities that are being actively used each week except over the week-ends could be made available for meetings. The general sessions were held at Columbia University and conference groups met there or at one of the twelve engineering schools of the New York metropolitan region that acted as host to the society.

The whole meeting centered on the place of engineers in the war effort. At the first general session on Saturday, Brig. Gen. R. C. Crawford of the Engineer School at Fort Belvoir, Va., spoke on the relation of the Engineer Corps to engineering schools. He was followed by four speakers who outlined the engineering needs of different war services, Lt. Col. C. E. Hixon speaking on the Enlisted Reserve Corps, Joseph W. Barker, former dean of engineering at Columbia, now on duty with the Navy Department, telling of the Navy's need for engineers, and William O. Hotchkiss, outlining the needs of the Army Specialist Corps., and Major B. R. VanLeer reviewing need of the Services of Supply.

A. A. White, president of S.P.E.E., in his presidential address discussed the task of the engineering colleges in the war effort, and that subject was amplified by speakers at two sessions on Sunday, including the talks by W. L. Batt and Karl T. Compton, previously noted. Reports bearing on this subject were submitted by the committee on acceleration of regular engineering programs, headed by D. B. Prentice, and the committee on conservation of engineering students, headed by W. E. Wickenden.

At the annual dinner held Sunday evening, speakers were Admiral George H. Rock of the Webb Institute of Naval Architecture, and Willard T. Chevalier, vice president, McGraw-Hill Publishing Co. At that dinner, the Lamme Medal for achievement in engineering education was presented to Roy Andrew Seaton, dean of the division of engineering and architecture and director of the Engineering Experiment Station at Kansas State College.

Group conferences were held Saturday and Monday. The civil engineering group met with the engineering economy group to hear three papers, one on economics and engineering education by James K. Finch, dean of engineering at Columbia University, a second by H. H. Meyer, of Sanderson & Porter, New York, "Some Factors Involved in Initiating an Economic Study," and a discussion of possible economies to be effected in the design and erection of steel structures, by H. S. Houghland, of the Bethlehem Steel Co., New York. The engineering drawing group devoted its attention largely to shipyard drafting problems and problems growing out of the war effort.

H. T. Heald, Illinois Institute of Technology, Chicago, was elected president to succeed A. H. White. Due to the death of F. L. Eidmann, second vice president, two vice presidents were elected this year, B. M. Woods of the University of California, and C. E. MacQuigg of Ohio State College. F. L. Bishop, University of Pittsburgh, was re-elected secretary and W. O. Wiley, treasurer.

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Suspension lifted on Chicago water engineer

Arthur E. Gorman, assistant city engineer of Chicago in charge of water filtration, who was suspended June 12 by Oscar E. Hewitt, commissioner of public works following a dispute, has been fully reinstated, according to an announcement by Mayor E. J. Kelly on June 25. Reason for the suspension was never made public, but under civil service laws charges had to be filed or the suspension lifted within 30 days.

Three-day rain causes flood damages in Missouri

A three-day rain in central Missouri, starting Wednesday of last week, has caused extensive floods in the valleys of the Missouri, Grand, and Osage Rivers. Highways have been flooded; and railroad traffic interrupted.

Precipitation during the storm totaled 2.77 in. at St. Louis; 4.08 at Jefferson City; 6.96 at Chillicothe; and 0.57 at Kansas City (all Missouri cities).

From Boonville to the mouth of the river above St. Louis (199 miles) all of the 1935 flood stages were exceeded. At Jefferson City the maximum stage was 29.6 which compares to a flood stage of 23.0. At Herman, which is about halfway between Jefferson City and St. Charles, a stage of 29.4 was recorded. This level compares with a flood stage of 21.0, and record highwater of 29.5 of 1903. Monday morning of this week the stage was 31.8 and was expected to start falling soon at St. Charles, where flood stage is 25.0, and record highwater of 1903 is 36.8. At St. Louis Monday morning a reading of 3 ft. above flood stage was recorded. However, major floods on the Mississippi are not expected as a result of this Missouri River flood. At New Madrid on the Mississippi in Missouri, where flood stage is 34.0, a maximum level of 30.0 is expected.

The Missouri Highway Department reports no bridges lost nor any large washouts, although several roads have been flooded. Railroad traffic had to be rerouted when tracks were flooded, but The Wabash had to reroute all traffic. No serious structure damage was reported.

Construction hits new high peak

Geared for war, the engineering construction industry piled up the huge volume of $4,905,294,000 for the first half of 1942. This tremendous total eclipsed the $2,841,403,000 reported by *Engineering News-Record* for the opening six months of last year by 73 percent, and surpassed all previous annual volumes, with the single exception of 1941.

In line with the war effort, $4,234,920,000, or 86 percent of the total, was for federal construction, just about three times the government-financed total for the opening half of last year.

Almost two-thirds of the 1942 construction total was for erection of public buildings. This volume, $3,197,373,000, exceeded last year's mark by 174 percent, and established a new all-time high for public construction.

Construction volumes in each class of work, and their percentage of gain or loss compared with the initial six months of 1941 are:

	1941	1942	% Gain or Loss
Waterworks	$38,171,000	$57,339,000	+50
Sewerage	52,473,000	53,274,000	+2
Bridges	66,324,000	33,550,000	−49
Earthwork, Drainage	101,102,000	199,360,000	+97
Street and Roads	302,799,000	228,576,000	−24
Public Buildings	1,163,928,000	3,197,373,000	+174
Industrial Bldg.	303,957,000	142,581,000	−53
Commercial Bldg.	298,502,000	168,317,000	−44
Unclassified	514,147,000	824,924,000	+60

OBITUARY

William V. Lustina, 56, construction engineer with the Pennsylvania State Highway Commission, died June 20, at Philadelphia. During World War I, Mr. Lustina served with the 27th Engineers as a lieutenant overseas.

Henry F. Morrisey, 52, prominent Canadian civil engineer, died at St. John, N. B., June 25. He entered the civil engineering profession in 1909 on construction of docks at St. John, and was later made assistant engineer of the St. Lawrence River ship canal. At his death he was district engineer for the Dominion Transport Department. Mr. Morrisey was a councillor of the Engineering Institute of Canada.

Charles Edward Bowron, 71, widely known engineer, died at Birmingham, Ala., June 17. He was a graduate of Vanderbilt University and had served as engineer with the Tennessee Coal, Iron and Railroad Co. at Birmingham, and for a number of years was chief engineer for the former Gulf Steel Corporation at Gadsden, Ala.

Alwin Hofmann, retired civil engineer, died June 23 at St. Louis, Mo. He was an engineering graduate of Washington University, and for many years was associated with the Ingersoll-Rand Co. He retired in 1938.

Charles A. Ewing, civil engineer for the Wisconsin Public Service Corp. for the last 33 years, died at Milwaukee on June 21. He was 87.

Henry O. Torke, 72, prominent building contractor of Milwaukee, Wis., died June 21.

Emmett O. MacDonald, of Sterling, Ill., who for many years was manager of the Lincoln Water and Light Co., died June 17 at Chicago.

W. A. Whitten, 54, construction superintendent for the G. A. Miller Co. of Tampa, Fla., died June 24 in Orlando. Mr. Whitten had constructed many of the army bases in Florida and other southern states.

Fred W. Weber, 90, contractor and builder in Apopka, Fla., for half a century, died at his home in Orlando, June 24.

CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION volume for the week totals $217,823,000, an increase of 37 percent over the preceding week. Public construction accounts for 91 percent of this week's total, and is 31 percent above a week ago. Federal work and state and municipal construction, which make up the public total, are 32 and 18 percent higher, respectively, than last week. Private work reaches its highest peak in the last four months, and is 162 percent above a week ago.

The current week's construction brings the 1942 volume to $5,123,117,000, a gain of 76 percent over the 27-week period in 1941. Private work, $361,651,000, is 51.5 percent below a year ago, but public construction is up 120 percent as a result of the 200 percent increase in federal work.

In the classified construction groups, gains over last week are in waterworks, industrial and commercial buildings, streets and roads, and unclassified construction. Increases over the short 1941 week are in waterworks, sewerage, industrial, commercial and public buildings, streets and roads, and unclassified construction.

New capital for construction purposes for the week totals $912,750,000, an increase of 91 percent over the total for the corresponding 1941 week. The current week's new financing is made up of $742,821,000 in federal appropriations for departmental construction; $82,700,000 in federal-aid for highways; $80,000,000 in RFC loans for industrial expansion; $5,729,000 in state and municipal bond sales; and $1,500,000 in corporate security issues.

CONTRACTS

(Thousands of dollars)

	Week Ending July 3 1941	June 25 1942	July 2 1942
Federal	$45,357	$139,437	$183,776
State & Municipal	17,465	11,682	13,804
Total public	$62,822	$151,119	$197,580
Total private	11,387	7,720	20,243
TOTALS	$74,209	$158,839	$217,823
Cumulative 1942	(27 weeks)		$5,123,117
1941	(27 weeks)		$2,915,612

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1941 27 weeks	1942 27 weeks
NON-FEDERAL	$785,965	$517,268
Corp. Securities	277,590	150,959
State & Mun.	278,602	156,190
U.S.H.A. loans	30,399	.....
R.E.A. loans	500	.....
R.F.C. loans	35,874	127,419
Fed.-Aid—Highways	163,000	82,700
FEDERAL	$3,041,337	$7,281,776
TOTAL CAPITAL	$3,827,302	$7,794,044

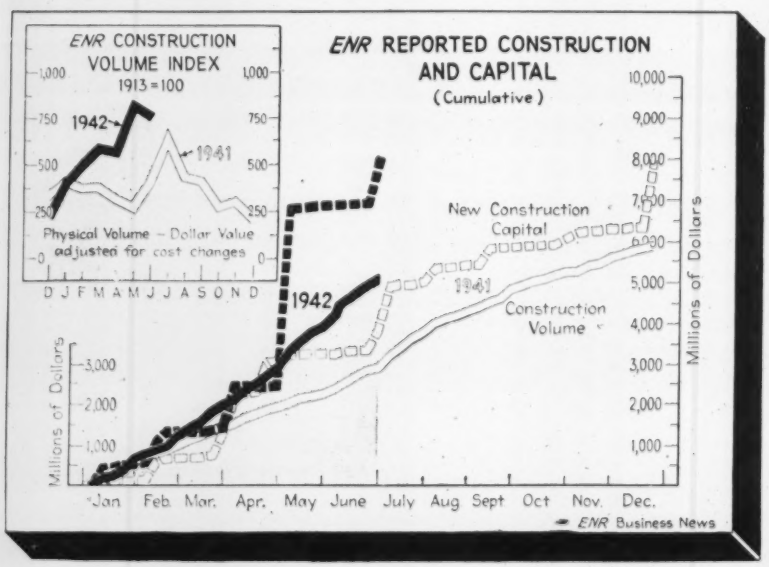
ENR INDEX NUMBERS

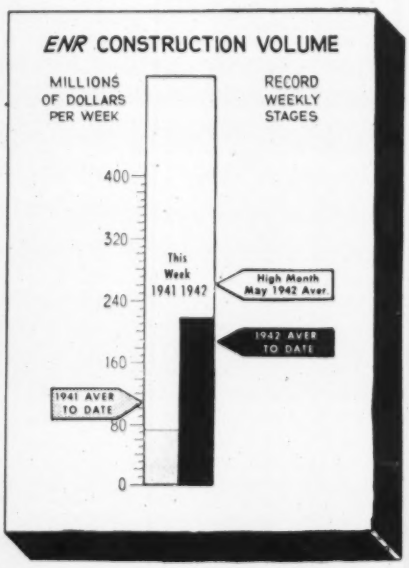
Index Base = 100		1913	1926
Construction Cost	July '42	277.65	133.46
Building Cost	July '42	223.45	120.79
Volume	June '42	752	330

FHA MORTGAGES

	Week Ending June 28 1941	June 20 1942	June 27 1942
Selected for appraisal			
Title II	$29,916	$7,190	$5,848*
Title VI	$ 5,767	$12,297	$14,527*

* Subject to revision.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1942
1941
Physical Volume – Dollar Value adjusted for cost changes
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
(Cumulative)
New Construction Capital
Construction Volume
Millions of Dollars
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
ENR Business News


ENR CONSTRUCTION VOLUME
MILLIONS OF DOLLARS PER WEEK
RECORD WEEKLY STAGES
This Week 1941 1942
High Month May 1942 Aver.
1942 AVER TO DATE
1941 AVER TO DATE

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Saving Steel in Concrete

Sir: Concerning the saving of steel in reinforced concrete the following comments are offered.

Safety factors: When we figure on safety factors we sometimes forget that they apply to the total of the dead and live loads. While the live load may vary, the dead load does not. Therefore, we have a superfluous safety load. For instance, with a safety factor of three, the limit load would be $3\ DL + 3LL$; but DL is realized only once and stays constant. Thus, we have a margin of $2DL$ which will never be applied and is superfluous. Then, instead of figuring the floor members for the code live load LL, we could figure them for the assumed load $LL' = LL - 2/3DL$. The limit load would become: $3DL + 3LL' = DL + 3LL$ giving us a safety factor of three for the code live load LL only, which is really what we intended all along.

Code live loads: The code live loads do not always correspond to the actual possible live loads, and the discrepancy varies with the kind of structure considered. In a warehouse, a church, a theater, a bridge, a tank, etc., the maximum code live loads specified can be reached, and it might be dangerous to reduce them. But in hospitals, hotels, office buildings, schools, stores, etc., the code live loads adopted are probably too high, at least in certain parts of the buildings. In stairways and corridors, live loads could not be reduced safely. But in office rooms, hotel rooms, hospital rooms, the live loads adopted are never reached, and could be reduced from 50 to 66 percent, which would help reduce the reinforcing steel.

Loaded area considered: When we consider a slab of relatively small span the probability of the span being fully loaded is great, say 100 percent. When we consider a beam carrying two slabs, the probability of its being fully loaded on the whole span is less. Therefore, a smaller safety factor might be used in proportioning the beam, to save steel. So much more so for a girder carrying several beams, and *a fortiori* for a column, carrying beams and girders. Already some codes allow reduction in live loads in certain cases for beams carrying 200 sq.ft. or more, and for columns carrying several floors. The principle could be safely extended.

Concrete mix: When we specify a rich mix, we intend to have shallow floor members, corresponding to larger sections of steel reinforcing. If then we specify poorer mix we will have deeper members and less steel reinforcing. In so doing we will use more concrete, we will have more dead load, but possibly we will use less cement, and certainly less steel. In this, like in most things, a just medium must be reached to realize the maximum economy corresponding to present conditions.

C. M. SIQUOT
Consulting Engineer
Baltimore, Md.

Savings in Detailing

Sir: Economies in the use of reinforcing steel have been given considerable attention at this time and rightly so. However, most of the attention has been directed to economies that can be effected in design, whereas in intelligent detailing and fabricating, considerable additional savings can be brought about.

To accomplish the savings in detailing will require a more intelligent approach to the problem than seems to be the case as it now exists. Unfortunately, detailing has been relegated to a routine tedious business, whereas it can and should be as important and interesting as planning and designing.

A typical illustration of intelligent detailing is in the spacing of bars in a one way solid slab panel. Placing of either temperature steel or main reinforcing close to the side of the beam or girder serves no purpose. A reasonable and logical procedure would be to start the spacing of the first main reinforcing bar twice the depth of the slab from the face of the girder and start spacing of temperature bars approximately one full space from the face of the beam. A saving of as much as 10 percent can be made in the slab reinforcing by giving careful study to the distribution of the steel.

Another saving can be made by eliminating stirrups in the effective area of the bent-up bars. The practice of disregarding bent-up bars in diagonal tension computations never was fully justified.

A still further saving can be effected in making the temperature bars serve double duty. This can be accomplished, and the use of loose bars over girders or walls eliminated, by making the temperature steel splices between girders or walls, and "hickeying" the temperature bars up into the top of the slab.

WILLIAM FLESHER
Harrisburg, Pa.

Concrete Design Procedure

Sir: The method of design proposed by A. J. Boase in "Saving Reinforcing Steel by Rationalizing Safety Factors," (*ENR*, May 7, 1942, p. 785) would be a marked advance in structural computation. The writer tried to draw attention to this question in *Western Construction News*, May 10, 1930, with the modification that live load and permissible stress should be increased. Obviously 0.7 dead load + live load to permissible stress is equal to dead + 1.43 live load to 1.43 times permissible stress. The writer has designed a reinforced-concrete frame for a department store in Kuala Lumpur (north of Singapore) on the basis dead load + 1.5 live load and 1.5 times permissible stresses. This means, of course, $66\frac{2}{3}$ percent instead of 70 percent of dead load, as proposed by Mr. Boase. It may be well to point out that the suggested change may actually be safer.

The conventional method treats the structure for loading conditions between dead load and live load, while the suggested change would consider the loads from dead load to 1.43 live load, and computations would actually cover a safety factor of 1.43 while at present no investigation is made as to change in moment distribution caused by increase in live load.

The conventional computation is unfair to reinforced concrete, since it is obviously safer to use an excessive load on a heavy structure than on a light one—a condition never taken into account, but of great importance at the present time.

V. BOGVAD-CHRISTENSEN
San Francisco, Calif.

EDITORIALS

VOLUME 129 NUMBER 1

July 2, 1942

Guns and Water

FULLY RECOGNIZING that water service is vital to winning the war, but equally realistic in regard to the crucial shortages of materials, J. A. Krug, chief, Power Branch, War Production Board, minced no words at the American Water Works Association meeting in Chicago last week. Said he in substance: There simply are not enough basic materials available, and the waterworks industry has got to get along with the most meager allotments, even if it means the sacrifice of adequate and dependable service. In times other than these, such talk would have occasioned a storm of protest from those who are schooled in the tradition that water comes first, above all things. However, the delegates who heard Mr. Krug were convinced that today there was something even more important than water service. That this may not have been fully appreciated prior to the meeting is indicated in part by the fact that water systems have been building up large inventories of materials and supplies in recent months. These surpluses must be used, warned Mr. Krug, and furthermore, civilian water consumption may have to be restricted in those areas where war plants and other war facilities would otherwise have to go on short water rations. Like rubber and aluminum, water is a basic resource necessary for winning the war. It, too, must be conserved and allocated—because the time has come when we can't have both guns and water.

Plywood Girders for Bridges

LACK OF STEEL for other than war needs is giving immediate usefulness to some types of research that otherwise might be chiefly of academic value for some time to come. Also, out of these studies may come knowledge that will prove useful after peace returns. The study of a plywood girder under the H-15 loading used in modern highway bridge design, as reported in this issue, is an example. The study showed that quite satisfactory girders for short spans can be built with plywood. The splice design used proved to be poor, but better designs are available. If plywood girders can carry H-15 loads they obviously command attention in the bridge field. As a beginning, they would seem to be adaptable for construction trestles where lightness in handling and ease of assembly are important factors, and they might even be used on secondary road construction after treatment to make them resistant to decay. Renewed interest in timber construction was evident before the war made steel scarce. Improved methods of preservative treatment and structural assembly should expand that interest. Thus the war is speeding development that might otherwise be spread over many years.

Our Job Is Ships

THE MARITIME COMMISSION adheres to the slogan "Our Job Is Ships." As the war has developed, this has become one of the critical jobs of the war effort as a whole, and at least a part of it is the responsibility of the construction industry. While the building of great naval vessels and liners has never concerned civil engineers and contractors, except insofar as they may have designed and built the shipyard facilities, the war has demonstrated that the collective brains and brawn of the engineered construction industry can make a substantial contribution when merchant shipbuilding goes on a mass production basis. In this issue the methods used in mass production of Liberty Ships in New England are described, and issues to come will carry similar articles on the operations at other shipyards. The ingenuity and daring characteristic of construction are being applied to shipbuilding with great success. A new chapter in construction "know-how" is being developed with which all engineers and contractors should be conversant.

For Better Sand-Bag Barricades

SINCE DECEMBER 7 sand-bag barricades in great quantity have been erected to protect important buildings from splinters and bomb fragments. Although many other types of blast wall construction are being used, most of them are more costly and require more time to build than do the piles of sand-bags. But burlap is now hard to get and its life in contact with damp sand is quite short. Much thought has been given to improving barricade design or increasing the life of exposed bags. Bag barricades have been coated with shotcrete, painted with asphalt, or both. In some cases, as the barricades were built up, steel bolts were laid between the sacks with threaded ends projecting on each side of the pile to engage 2 x 4's, which increased the stability of the wall. At a well-known airplane factory cement mixed with the sand in the ratio of

1 to 24 increases stability and prevents sand from running when the sacks decay. San Francisco has made extensive use of an asphalt-sand mixture (*ENR* Jan. 15, 1942 p. 77) that is expected to hold its shape indefinitely even after the sacks have been entirely destroyed. If weatherproof coatings can be put on barricades while the sand is dry, they probably will be relatively durable, but a safer and surer method seems to be the use of admixtures of asphalt or cement. This war has already outlasted damp burlap.

Glass in Air Raids

WHAT SAFEGUARD will best minimize risk from flying glass when concussion from a bomb explosion in the street shatters window glass and tends to blast it into the room? This problem is now current wherever the possibility of enemy air raids is being considered. San Francisco has been making tests of window glass protection, and is considering others as outlined recently in this journal. The glass manufacturing companies also are carrying on intensive studies, and a most excellent report has been published by the Pittsburgh Plate Glass Co. Four sentences from this report state the "glass-in-air-raids" situation succintly and accurately:—"There is no method of preventing the fracture of window or plate glass under blast or impact. Certain types of flat glass, such as tempered glass, laminated safety glass and wire glass, enjoy greater resistance than ordinary glass, and should be considered in making replacements in locations that must be kept glazed. Since it is not practicable to prevent entirely the fracture of commercial glass in fixed openings, efforts should be directed toward minimizing the results of breakage. In all cases, the protective means used should be securely fastened to the frame or other construction supporting the glass."

Once these basic criteria are accepted, the actual methods of protection are largely a product of common sense and investigation. So far it has been shown that adhering fabrics, if attached to frame as well as pane, do some good; that sodium silicate or animal glue should not be used as adhesives since they etch the glass; that wire netting, of ½-in. mesh or less, attached to the frame affords good protection; that excellent protection is given if the wire netting is attached to a separate frame that is free to swing under blast; and that bracing devices to prevent vibration do not give protection.

Inescapable is the conclusion that complete protection is possible only by boarding the windows on both sides or removing the panes entirely. The fact that neither of these alternatives is often practicable merely emphasizes again that in modern war there is no such thing as absolute safety.

Revolution in Materials

NO ONE COULD ATTEND last week's convention of the American Society for Testing Materials without acquiring a feeling of concern with respect to our materials situation on the one hand, and a feeling of optimism respecting its outcome on the other. What is most significant is that the optimism is well based on past performance in solving shortages of critical materials by the smoothly functioning machinery of industry-consumer committees that make up the A.S.T.M. The procedure worked out a year ago for issuing emergency alternates for those specifications temporarily outmoded by war's demands bore fruit in at least 50 instances. And there was ample evidence that research is being directed straight to the heart of new shortage problems that are looming on the horizon.

Optimism for the future may also be based on the fact that much of this emergency work is turning up information of permanent value. Some of the "lean" alloy steels, for example, have proved equal or superior to their "rich" predecessors. The seemingly endless battle to conserve alloys, first by substituting manganese for nickel, then by using molybdenum for manganese, is producing some promising combinations. A re-examination of the properties of modern Bessemer steel opens up a wide field of applications for this once-discarded product. In short, there is much support for the contention, often heard, that "substitute" is the wrong term to apply to emergency materials. They may be "alternates" or "choices," but not "substitutes" in the sense that they are inferior.

Terminology, however, is not particularly important. Eventually the materials themselves will answer the question of which ones are superior and which inferior. The important thing is that such organizations as the A.S.T.M. contain within their membership the ability to feed efficient materials to the war machine, come what may. And the result is a materials revolution that will not only shorten the war but carry over into peacetime pursuits.

ENGINEERING NEWS-RECORD WALDO G. BOWMAN, *Editor* *Copyright 1942, by McGraw-Hill Publishing Company, Inc.*

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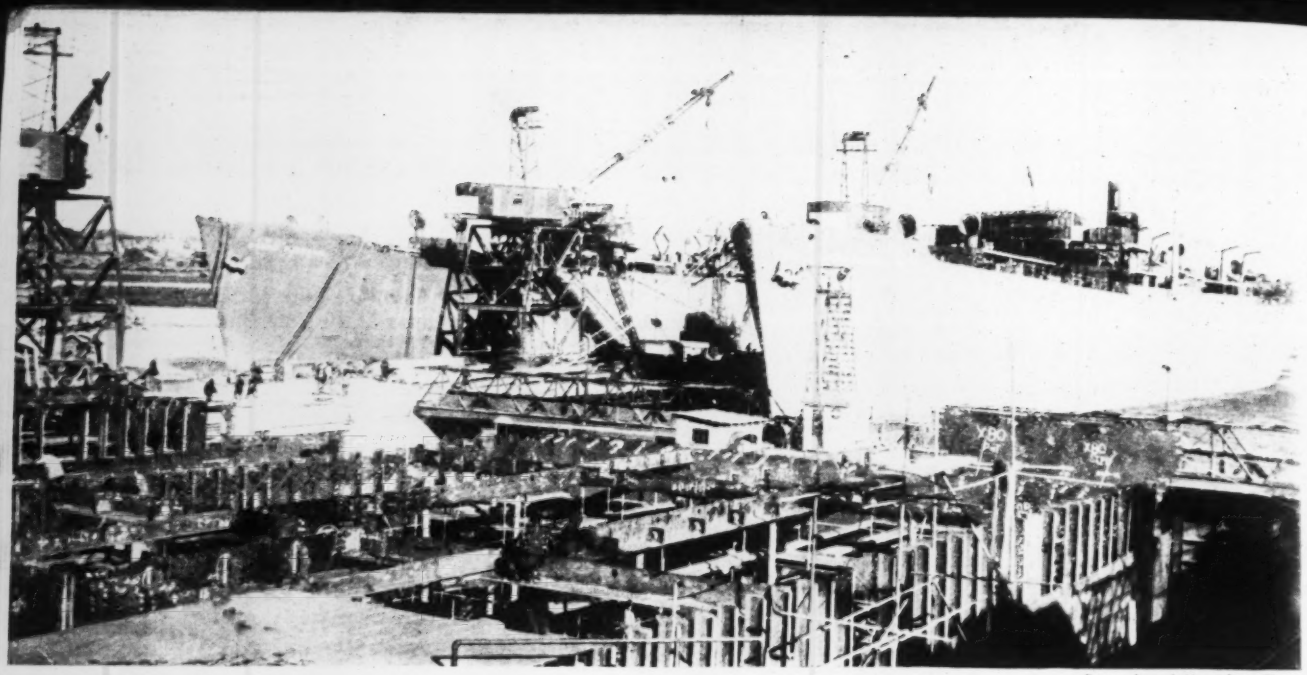


Press Association, Inc. Photo

Fig. 1. British prototype of the Liberty ships is fitted out after construction on a level keel in a shipbuilding basin.

Liberty Ships Built in Basins and on Ways

***Contents in Brief**—On adjacent sites at South Portland, Me., Liberty ships for the Maritime Commission are being built on conventional ways. A British forerunner of the same design is under construction in a special basin. Shop assembly utilizes the machines and methods familiar to construction men. Prefabrication of parts is used for sub-assembly into the largest units conveniently handled, and welding is employed for all connections except fastening the exterior plates to the ships's frame.*

CONSTRUCTION of part of the rapidly expanding "Bridge of Ships" to carry the products of American industry to the war fronts is underway at two yards at South Portland, Maine. Here in a special basin, Todd-Bath Iron Shipbuilding Corp. is constructing 30 freighters for the British Purchasing Commission that were ordered prior to the start of lend-lease. Nearby, the South Portland Shipbuilding Corp., under the same general management, is building ships for the U. S. Maritime Commission on conventional ways. The British vessels are a prototype of the well-known Liberty ship of which about 1,500 are now under contract for construction in plants on the Atlantic, Pacific and Gulf coasts.

Construction of these ships requires the use of materials and methods familiar to bridge designers and the average construction workman. Steel is the dominant material used: large cranes on high gantries handle the sections; welding is superseding riveting; and the small tools of normal construction all are employed. There are perhaps three major differences between ship construction and the operations more familiar to the civil engineer and heavy construction contractor: steel plates predominate, with shapes used as secondary members; construction is a repetitive process—as rapidly as a unit is finished it is moved out and another is built in the same place; and fabrication is done at the site of the work through subcontracting — pre-assembly of parts makes this distinction less noticeable at some yards.

Liberty ships, and their English counterparts, are single-screw steamers of 10,500 long tons deadweight, of which 9,146 tons is available for general cargo. The light weight of the ship is 3,600 tons, making a total loaded weight of 14,100 tons. These vessels are 441 ft. 6 in. long overall, 417½ ft. at the water line, have a 57-ft. beam and are 37 ft. 4 in. deep; they are designed with a nearly flat-bottom to reduce work of fabrication and speed of the assembly. Along the radius where the plates change from nearly vertical to the flat-bottom, a bilge keel (a 12-in. projecting fin) on the hull acts as a stabilizer to dampen the roll of the vessel. The ships have two complete decks above which are a boat-deck, bridge-deck and navigating bridge. At light weight the boats are about 12 ft. in the water and when loaded have a draft of 27 ft. The hull is divided and reinforced by seven main bulkheads, watertight to the upper deck, providing five main cargo holds and a machinery space.

The freighters are driven, at a speed of more than 11 knots, by a 2,500 indicated hp., 76-r.p.m. direct-acting, surface-condensing, triple-expansion, marine-type engine that has 24½-in., 37-in. and 70-in. dia-cylinders working on a 48-in. stroke. The engine operates at 220 psi. with steam superheated to 450 deg. F. It is located amidships with a 13½-in. dia. forged-steel shaft to a four-bladed 18-ft. dia. propeller.

Liberty ships have two water-tube boilers, each designed to evaporate 24,000 lb. of steam per hour burning bunker C fuel oil in four burners;

those being built for Britain have three Scotch marine-type fire tube boilers (made in this country) hand-fired with coal. The British prefer coal as it is a more readily available fuel at most ports. More cargo space is provided on the American vessels by utilizing the usual bilge space between the bottom plates and inner-bottom, and other not easily-loaded spaces, for oil storage.

Normal crew on a Liberty ship is 22 men above deck and 15 below with 7 stewards, cooks, etc., a total complement of 44 men. Most of the personnel is housed on the upper deck amidships, with the officers immediately above on the boat-deck and the captain and radio men on the bridge-deck.

Not examples of shipbuilders' art

Building of the freighters is more nearly a construction, fabrication and erection job than it is a normal shipbuilding procedure. The mold loft, where patterns were formerly laid out full-size for each plate of each individual ship, has given way to mass production methods, and the painstaking care of old-time shipbuilding craftsmen necessarily has been abandoned. Instead, heeding the cry for ships and more ships, pre-fabrication, pre-assembly and other speed-up methods are now being employed.

Procedures on shipbuilding follow a pattern similar to that on other construction. At each of the yards in South Portland facilities are provided for storage of plate and structural members and for processing them into the proper size and shapes. Huge plate and fabrication shops have all modern machinery for cutting, shaping and welding the steel needed for construction. Main plates used in the ships are in sheets up to 88 in. wide and vary from $\frac{3}{8}$ to nearly $\frac{3}{4}$ in. thick. An assembly yard was first set up outside, but the rigors of a New England winter indicated the desirability of an enclosed area for this work, the structures being erected while assembly operations were underway. Traveling overhead cranes handle the material in the fabrication shop and in the assembly building.

It was not considered economical to build railroads into either of the two sites, especially as storage area at the yard locations is very limited and plate is necessarily stored elsewhere. Motor trucks haul from the plate yard to the fabrication shop while push-cars on standard gage track are used to transport the pieces through the shops. As steel is bent and fabricated it moves to an area where sub-assemblies of parts are made into the largest sections that can be handled. The double bottom of the ship is assembled upside down with floors and girders in place so that much of the welding can be done downhand instead of overhead. The bow section is pre-assembled, also in upside-down position.

The assembled pieces are carried from the yard to their designated position in the hull by 25-ton capacity full-revolving cranes mounted on high gantries. The original plan was to use standard railroad flat cars for transfer, but this was found impractical as larger sections are assembled than can be moved under the gantries. The area between the gantry tracks is used instead for construction workers' sheds and storage of fabricated parts.

The ships for Britain are constructed in a watertight basin, made up of a series of seven berths side by side. Each berth is about 475 ft. long and 77 ft. wide with the floor 7 ft. below mean low tide. The basin is entirely enclosed to well above high-tide level and the water pumped out to permit construction on a level keel in the dry. Each of the berths is separated by sufficient space for a crane runway. At two points a watertight concrete bulkhead 23 ft. wide divides the basin into two areas with two berths each and one section with three berths. The bulkheads support a gantry crane, and between berths where no bulkhead exists a structural frame carries the crane.

Water can be admitted to the small basins individually to float the vessels and each berth is provided with a gate across the seaward end that can be removed to permit taking a ship out of the dock. Construction of this basin required that the entire area be enclosed in a cofferdam (*ENR* June 5, 1941, p. 886) so that subaqueous work could be completed.

Fig. 2. Construction of the bow section. All plates are welded watertight but are riveted to the frame of the ship.

Stanley Dana Corp. photo

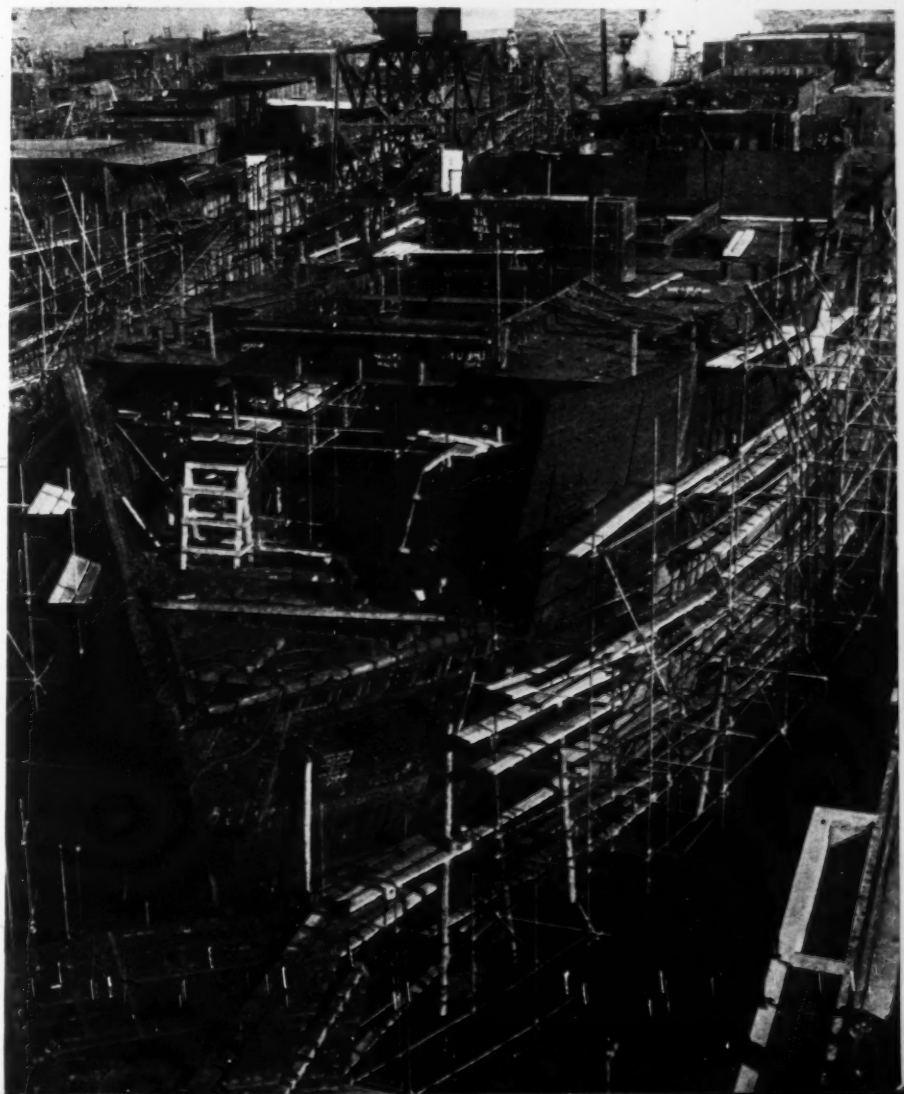
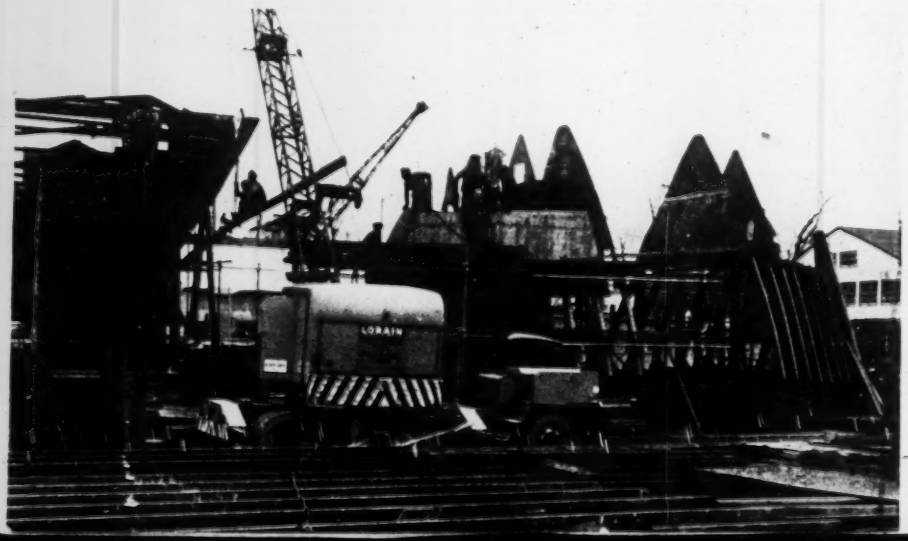


Fig. 3. Bottom plates are laid out and welded and then the pre-assembled double bottom is laid on this to start the hull construction.

Construction in such a basin is more rapid because the ship is on a level keel eliminating computation and slower layout necessitated by assembly of the parts on other than horizontal and vertical lines. Materials do not have to be hoisted high to go into place, and men have only a short distance to climb either up or down to their work as the dock level is about mid-height of the hull. Construction and launching from the basin is safer and simpler than with shipways.

Launching is much less of a ceremony; water is admitted to the basin after ships are completed to the point where they can be floated, and as the rising water lifts them from the blocking the actual launching is completed. After the water pressure is equalized on the two sides of the gate—a straight, roller type built in six sections across the 70-ft. opening—the individual sections are lifted out by the dock crane. The vertical supports then are removed to make a clear opening through which the ship can be towed.

Fig. 4. Upside-down assembly of bow sections using a truck-mounted crane for handling smaller pieces to free the gantry cranes for heavy loads.



Construction procedure in the basin is to set a series of vertical keel-blocks, at the frame spacing of the vessel, extending about 2 ft. above the basin floor. A light timber falsework, Fig. 3, is set full width of the bottom of the ship to carry the bottom shell plating. These plates, bent and shaped in the shop, are laid out by the crane and are then welded together, following which the double-bottom is placed.

The double-bottom is a sub-assembly job and has the "floors" or stiffeners between the outer and inner bottom welded to it while in upside down position on shore to eliminate overhead welding. Pre-assembled bulkheads are erected and then the shell plating set progressively to the top of the hull. All plates are welded together and all the connections in the ships are welded except that the exterior plates are riveted to the side frames of the vessel.

As construction advances, the timber framing under the ship is gradually removed and replaced with a few pine shores that bear against angle brackets welded to the plates of the hull. Prior to flooding the basin, most of these supports can be removed, leaving the ship resting almost entirely on the keel-blocks under the center and on some longer shores to above the water line on the sides.

Working platforms inside and outside the ship rest on pipe scaffold rising from the dock floor or the decks of the vessel. This type of scaffold has the advantage of being safe, light, quickly moved or erected, gives more light and working room underneath as well as reducing the fire hazard.

The first freighter built in the basins was assembled with the stern at the water end as is always done with ships built on ways. Subsequent ships are being erected with the stern toward the assembly yard as the larger amount of material goes nearer the stern. The ton-miles of carrying with the gantry crane can thus be reduced and the crane kept nearer the shop end of the dock for use in turning assemblies or handling pieces.

Liberty ships for the Maritime Commission are constructed on conventional ways at the nearby South

Portland Shipbuilding Corp. plant and follow the same general procedure. The vessel is supported on blocking along the center line and on a framed platform at the start of construction, but the latter is gradually replaced by shores set against the hull. As the ship approaches a stage at which it can be floated, its weight is transferred to the launching ways. The ways consist of two sets of three heavy timbers each serving as skidways. They are located a few feet on either side of the center line of the vessel, and over them a layer of grease is placed as launching time approaches. Above these timbers is the launching cradle, consisting of two sets of three timbers, on which are laid long hardwood wedges spaced only a few inches apart. Over them another series of longitudinal timbers is laid almost against the hull, and the wedges driven to pick up the weight of the ship and transfer the load to the launching ways.

Fitting-out piers

Under both methods of assembly the vessels are launched as quickly as work progresses far enough to permit moving them out for completion at a fitting-out pier thus making way for assembly of another vessel. Installation of power and fitting of the ship are speeded to have as much of the work done as possible while it is held steady on the blocking; but the present rush for tonnage and the small number of shipways available make it imperative that the ways be cleared for new construction at the earliest possible moment. The boilers are placed in the ship early as they are in an otherwise inaccessible location below deck. Engines may be set while on the ways or at the fitting-out pier depending upon the time available.

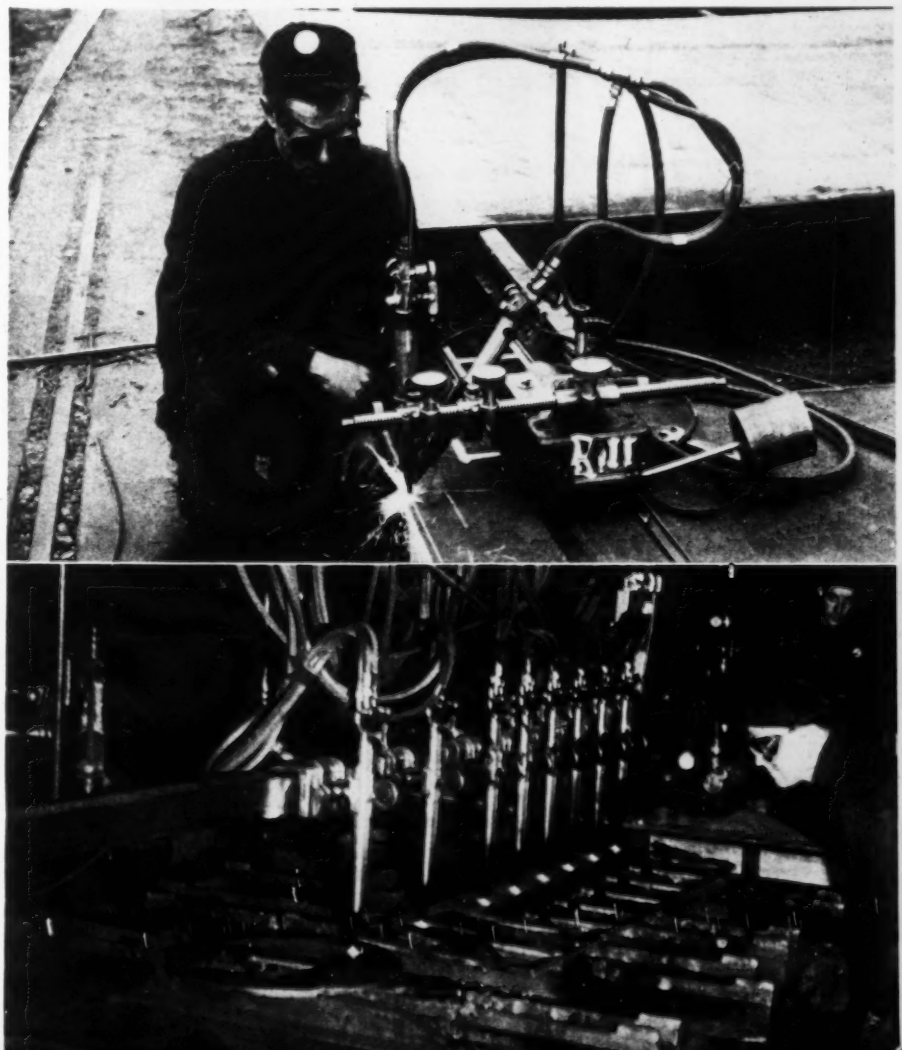
The fitting-out piers are long structures, providing berthing space for several ships at a time, and are wide enough to accommodate parallel high gantry cranes on separate tracks, with a space left between for rail delivery of essential materials. However, in these yards rail delivery has not been used and the central area is available for storage. Trucks haul all materials, using the space between the gantry rails as a roadway. Machinery, interior fittings, cargo handling devices and other essentials are added to the boats and they are completed here ready for their cargo.

Personnel engaged in ship construction in the Portland area has increased more than 13 times since 1938, making it necessary to employ workers not at all familiar with ship construction processes. State-owned and operated schools are conducted for many of the trades: welders, burners, pipefitters, pipe coverers and others. Classes are conducted at convenient hours so that men working in the yard may attend. Some restriction is placed on skilled employees taking other courses as it would only lead to undesirable change of jobs in the organization. In some cases an advance for living expenses is made to prospective employees from areas beyond commuting distance to make it possible for them to stay in Portland to learn the work before becoming regular employees.

Parent company of both yards in South Portland is the Bath Iron Works which shared its key personnel to start the new plants. William S. Newell is president of the three companies, Archibald M. Main, executive vice president, G. V. Pach, vice president in charge of finance, Thomas R. Allen, vice president in charge of production, Roland F. Hill, vice president in charge of procurement, H. B. McClellon, general manager of Todd-Bath Iron Shipbuilding Corporation and Thatcher B. Pinkham general manager of the South Portland Shipbuilding Corporation.

The ships for the British at the Todd-Bath yard are under the supervision of J. S. Ormiston of the British Purchasing Commission. At the South Portland Shipbuilding Corp. James T. McNeil, acting principal hull inspector and Everett C. Orne, acting principal machinery inspector, represent the U. S. Maritime Commission of which Emory S. Land is chairman and H. L. Vickery vice-chairman.

Fig. 5. At top: A graduate of the burner school at the Todd-Bath yard makes a cut and a bevel with a semi-automatic machine running on a special guide. Below: multiple blow torch following a pattern with small wheel at the right, makes eight similar pieces simultaneously, in this case small fillets cut from scrap.



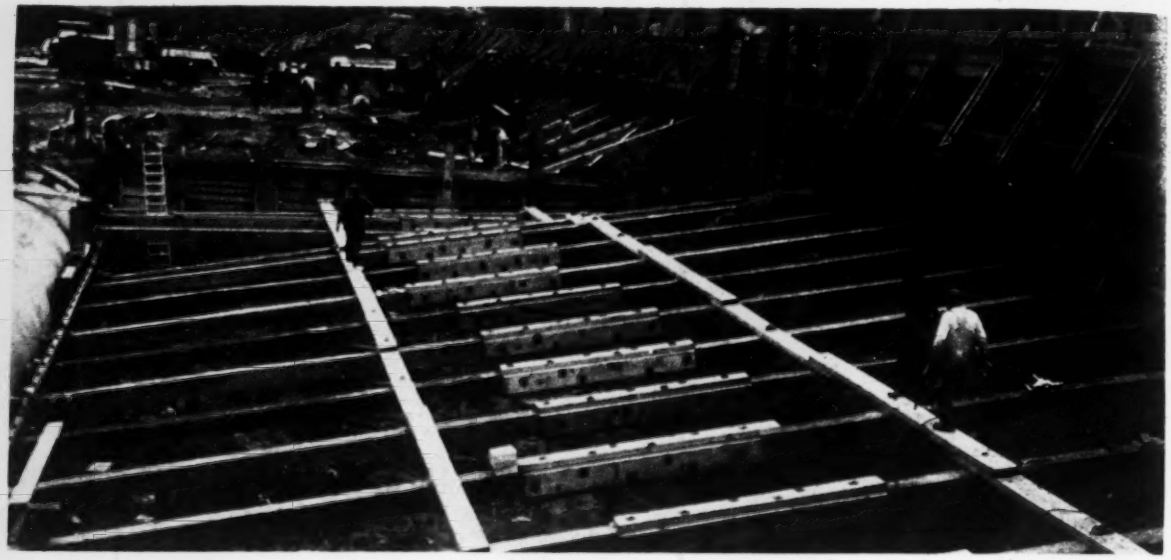


Fig. 1. Long shores and anchor piles driven through the street pavement hold wall excavation in Washington, D. C.

Special Shoring for Building Excavation

***Contents in Brief**—Steel H-beams were driven to a toe-hold in soft rock and tied back to pile anchors that utilize the existing pavement to hold the banks for excavation of a steam plant substructure in Washington, D. C. Horizontal breast boards are used back of the vertical beams to a depth where wellpoints are required, then they are set just inside the exterior flanges and the wellpoints driven back of them. Reshoring, as the structure rises, is done to obviate the necessity for struts through the concrete.*

EXCAVATION OF EARTH to below water-bearing substrata as well as protection from high banks required unusual shoring that uses the adjacent street pavement as a horizontal beam for anchorage in the construction of the West Central Heating Plant for the Public Buildings Administration in Washington, D. C. Wellpoints are used below the groundwater level, driven in line with the vertical shoring.

The project is just above tide water level and along Rock Creek in a partially built-up area. The site is fairly level but along one side the land rises sharply and at one point the bounding street is more than 25 ft. above the stream level and 50 ft. above the deepest excavation. Immediately below the high section of the street it is necessary to excavate to a considerable depth and out to the property line. Along this side of the excavation special precautions are necessary to keep the street open and to maintain the ground support necessary to prevent any movement of the street or the structures on the opposite side.

Main members of the shoring, H-beams 14 in. deep, weighing 102 lb. per ft. and 8 ft. 6 in. c. to c., were driven vertically to a toe-hold in soft rock by pile drivers operating on the street. To hold the tops of the beams against the thrust of the earth, vertical wood piles were driven back about 40 ft. from the edge of the excavation.

The pavement of the street is used here in a novel way to assist the anchor piles in resisting the thrust on the driven beam. A pocket was opened through the bituminous wearing surface and concrete base of the street, and the pile driven through this opening and its top was cut-off flush with the surface of the concrete. A trench was cut from the pile to the beam and tie rods installed as shown in Fig. 2. The concrete base of the pavement was then restored across the trench, the concrete being placed solidly around the anchor pile, thus adding the beam action and sliding friction of the entire paving slab to the value of the anchor pile. The wearing surface was replaced to permit use of the street.

Excavation to the level where shoring was necessary, was done with power shovels. However, immediately along the wall adjacent to the high street, excavation was accomplished with a clamshell bucket supplemented by hand work. Horizontal breast boards (3 in. and 4 in. timbers, depending on the depth and pressure) were inserted back of the vertical beams. To prevent loss of ground the excavation was lowered only a foot or so at a time and carefully cut along the back to the exact face required by the breast boards. A small space was left between the individual breast boards for groundwater drainage to eliminate any possibility of hydrostatic head against the sheeting. These openings also are utilized to permit packing earth back of the boards to fill any voids that may occur during their installation.

Heavy shoring became necessary as the depth of the excavation increased.

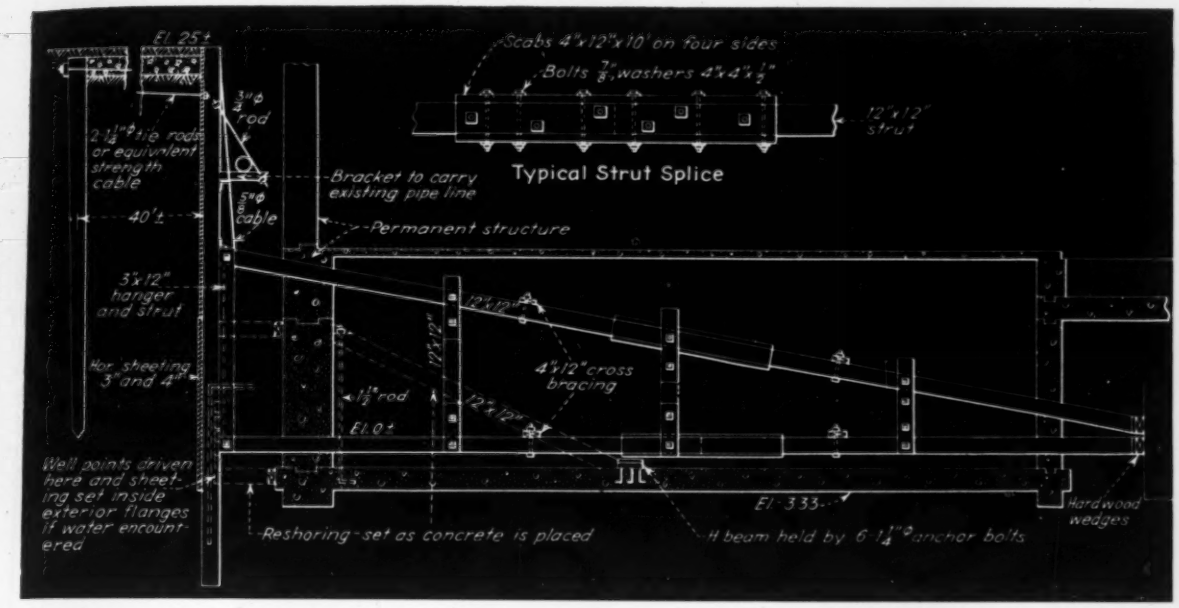


Fig. 2. Detail of shoring and reshoring for excavation. Where excavation is deeper one or even two more struts are used.

timbers being placed as shown in Fig. 2, with up to four struts used where the depth is great. Excavation between the struts, set one above another in a vertical line, is completed with clamshell buckets, the lower struts being added as the excavation proceeds.

Where water is encountered the procedure is to drive wellpoints between the vertical beams and as close to the breast boards as possible. Below this level the earth is removed to just inside the outstanding flanges of the beams, and the breast boards slipped inside the flanges. The excavation may then be carried as deep as is necessary with the protection of the wellpoints but without interference from them.

Following completion of successive levels of the building, the vertical steel H-beams are reshored so that the permanent structure carries the thrust of the earth bank. The concrete forms can then be erected without interference from the struts and the concrete placed without boxing out around them. When the floor slab is placed the anchor for the diagonal strut (Fig. 2) is placed with it. Reshoring in the plane of the floor can be done and then the lower strut removed. After pouring of the first lift on the wall the short diagonal strut can be used to release the long shore.

John W. Shorrock is construction engineer in charge of the work for the Public Buildings Administration. Contractor for the improvement is Chas. E. Tompkins Co. of Washington. Frank Transou is foundation superintendent on the work described. J. Slater Davidson, Jr. is general superintendent and Francis M. Tompkins is project manager on this and other work for the Chas. H. Tompkins Co. of Washington.

Fig. 3. Excavation along the high bank is done by hand in shallow advances followed by placing of horizontal breast boards back of the driven vertical beams.

Fig. 4. Timber bracket forms temporary support for existing pipeline.

Fig. 1. One runway complete, forms and equipment are being transferred to another being graded in the background.

Paving Runways at Half a Mile a Day Clip

***Contents in Brief**—Using a single battery of equipment, a contractor paved 2,200 ft. of 25-ft. wide concrete runway strips day after day. Working hours were from 5 a.m. to 9 p.m., and the best record was 3,100 ft. in 15 hr. Two pavers on the subgrade laid the first course, the reinforcing mesh was then installed, and a third paver alongside the forms finished the pavement. The runways were ready six months ahead of schedule.*

NOT EVERYTHING is "too little and too late." There is, for example, an Army airfield in the northeastern part of the country that was ready six months ahead of schedule. Having anticipated building only 60 percent last fall and the remainder this spring, the contractor was instructed to push the whole thing to immediate completion and, by careful planning, successfully did so. Starting late in August, by Nov. 15 he had graded a 550-acre site, placed nine miles of 12 to 72-in. concrete drainpipe and paved three 150-ft. wide concrete runways totaling nearly 15,000 ft. in length, which were laid out in the form of a triangle. As part of a large military establishment, this will some day be a busy and, when its operating story can be told, a famous flying field. In the meantime it is available for use by our warplanes and has been for six months past because of the adoption and successful execution of a schedule in keeping with the needs of the times.

Two things are significant about the job: first, that the extensive airfield facilities were built in the record time of 54 working days without recourse to anything more than good organization and a hard working, enthusiastic crew that would work long hours; and second that, but for conditions special to this job, the speed could have been materially increased. One limiting condition was a requirement that one leg of the runway triangle be completed and available for use at the earliest possible moment. This condition made it necessary to confine the initial operations to a single runway, and this caused a delay in the job at the end of every paving strip while the equipment was shifted to a strip not adjacent to the one just poured. Had it been possible to pave a strip entirely around the triangle, less shifting of equipment would have been required and then only to an adjacent strip since the last-poured strip would have had its necessary seven days of curing. Placing 2,200 ft. of 25-ft. wide strip a day, as was consistently done, would have taken the paving equipment around the triangular runway course in approximately seven working days.

The possibility of cutting construction time by paving continuous strips around the entire triangle, instead of going back and forth on the strips in only one leg, is mentioned solely for the suggestive value it may have on jobs where such procedure is permissible; and the possibility is significant only because this particular job was in itself an unusually fast one. Laying 2,843 ft. of 25-ft. wide pavement in 15 hr., the record on this job, has, it is believed, seldom been exceeded.

There were, as stated, three runways arranged in a triangular pattern. Each runway was built in six strips 25 ft. wide and of 9-7-9-in. thickness, placed in two courses with reinforcing mesh between. There was a dummy joint down the center of each strip, and expansion joints were placed transversely every 120 ft.; transverse dummy joints were also cut every 20 ft. If the strips of a 150-ft. runway are considered as being numbered 2, 4 and 6 on one side of the center line and 1, 3 and 5 on the other side, the numbers give the order in which the strips were paved.

The equipment lineup was as follows: two pavers operating side by side on the subgrade, to place the base course; one paver operating outside the forms to place the top course after workmen had installed the reinforcing

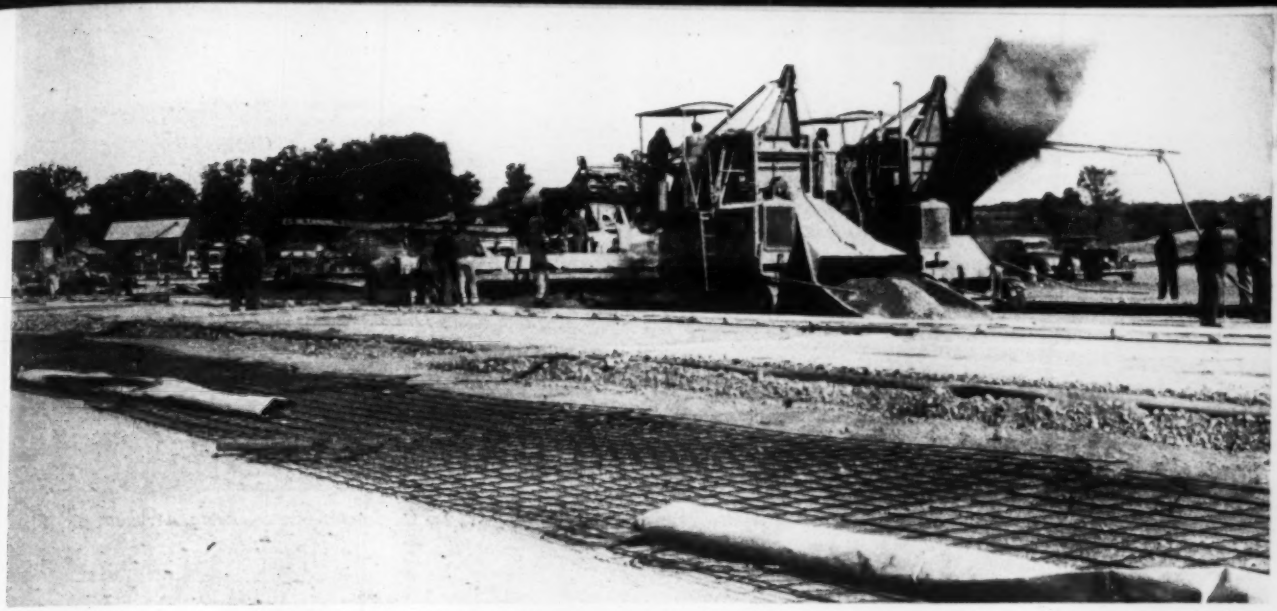


Fig. 2. Paving equipment which laid 2,200 ft. of slab daily. Two mixers operate on the subgrade, while a third on the far side of the forms places the topping course after the reinforcing mesh is installed.

mats; and, operating on the forms, a mechanical spreader which also struck off at the correct elevation for the reinforcement, two 2-screed finishing machines, and a dummy joint machine which scored both the longitudinal and transverse dummy joints. In addition, a scratch template was used ahead of the pavers to aid in preparing the subgrade.

Materials were brought to the pavers in trucks from a job batching plant. These trucks entered and left the subgrade through openings placed in the forms at 150-ft. intervals, a traffic control feature that proved very effective. The opening nearest the pavers was used as the exit while the one next farther away was the entrance. Trucks always passed through the openings moving forward. The procedure was for a full truck to run in on the subgrade, stop and back up 150 ft. to the exit where it waited for the empty truck to move out. Then by the time that it backed the rest of the way to the paver, the skip was down and ready for a new batch.

Only one special condition arose to disturb the even working of the job schedule. This resulted from a total of 9 in. of rain during the month of October. Following these rain storms the subgrade was often left quite soft. Procedure then was to use 15-yd. crawler-drawn scrapers to remove the film of muck. After adding the necessary dry material to the subgrade, work could be resumed in a remarkably short time after the rain stopped.

One feature of the job was the care taken to avoid delays from breakdowns. Thus dual water lines were laid for the pavers: two 75-cu.yd. per hr. batchers were installed instead of a single 100-yd. unit which might have been ample; and spare parts for the equipment were kept on the job.

Given this equipment set-up and schedule of operations, progress depended in the final analysis on the drive and teamwork of the men. The work day was from 5 a.m. to 9 p.m., and finishing operations often continued until 1 o'clock the next morning. Illumination for night work was supplied by floodlights on skid-mounted towers, electric current coming from small gasoline-engine-operated generators also on skids.

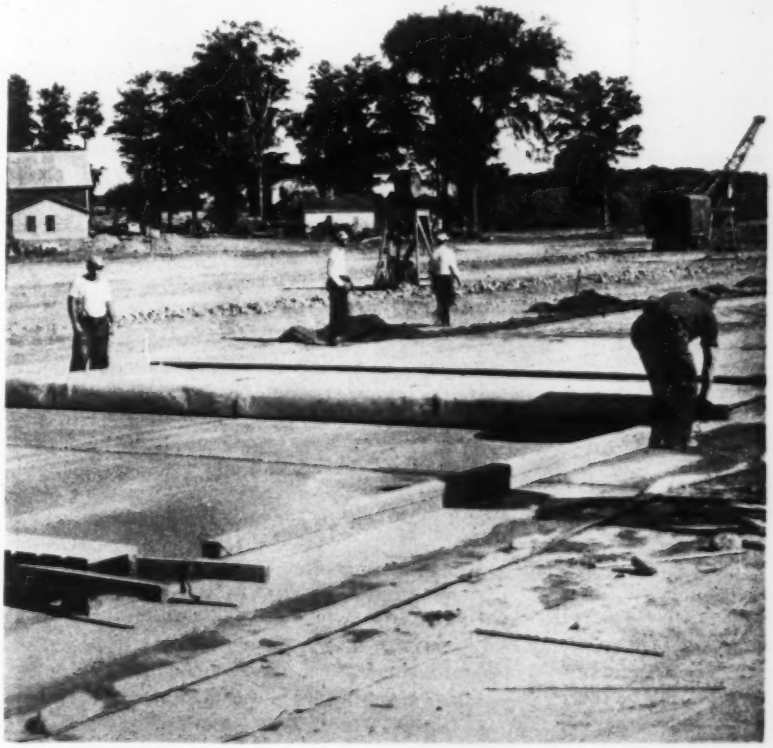


Fig. 3. Rolling curing paper over the concrete was a fast operation. In the center background is one of the portable floodlights for night work.

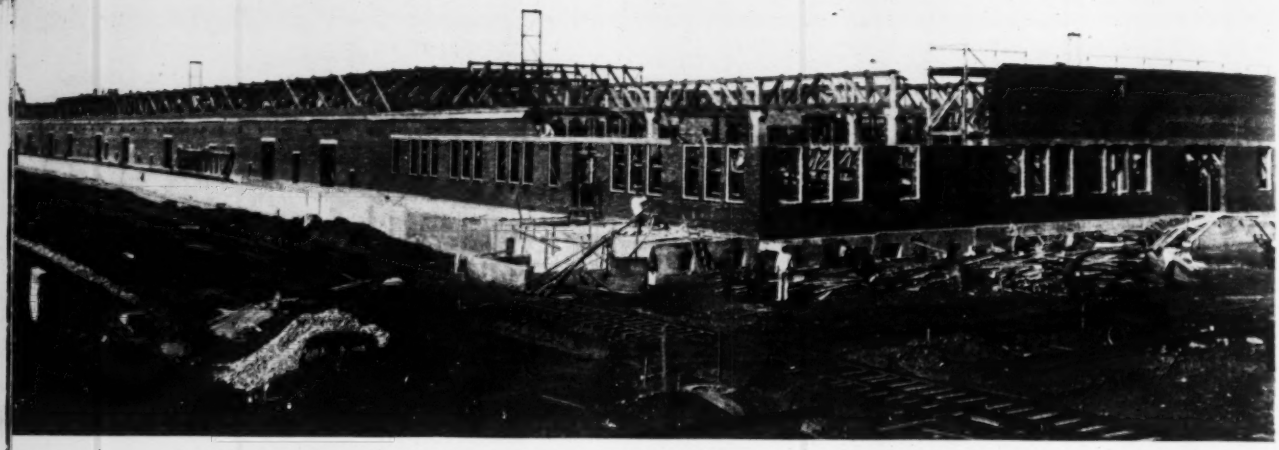


Fig. 1. Brick walls, precast concrete lintels, wood frame windows, and timber trusses feature Army warehouses.

Construction Expedients on Warehouses

***Contents in Brief**—Practical "fabrication in transit" of timber trusses was adopted to speed construction of six 180x960-ft. warehouses, the first completed in 16 weeks from date of authorization and the others finished at the rate of one each week. Other means employed to save time and money were use of sloped floors to reduce earth-moving and paving of 40x60-ft. bays without construction joints.*

FLOORS SLOPED to reduce earth moving, prefabricated timber trusses delivered completely and ready for installation at the job site, and paving over large areas at one time, were used to speed construction of six 180x960-ft. warehouses for a regulating depot built by the Corps of Engineers for the Quartermaster Corps of the Army. These warehouses follow a standard design intended to conserve strategic materials but some changes were made to further simplify and speed construction. The changes in design and the construction expedients used permitted on time completion of what seemed at first to be an impossible schedule.

Timber trusses, fabricated in transit and delivered on the job as a steel truss might be, were used for the warehouse roof in spans of 40 and 60 ft. Timber members were cut, drilled for bolts and ring connectors, and marked on the West Coast, and then shipped across the continent closely packed in box cars. Along a railroad sliding the fabricated pieces were assembled into completed trusses and were shipped into the depot on flat cars. Each of the six warehouses required 48 trusses of 40-ft. length and 132 trusses of 60-ft. length, a total of 1,080 trusses.

Fabrication of parts on the West Coast was adopted to save time and to permit fabrication in a shop specially equipped for such work. Assembly of the trusses was done outside the depot area, permitting delivery to the job of a finished product. This limited cost control to a single purchase entry and reduced the inspection required to the finished article.

The order for complete fabrication of the trusses prior to arrival at the site suffered some delay in approval, so that delivery of trusses for one building was specified in 42 calendar days and completion of the entire order in 79 days. In an open work area outside the depot site, a crew of 50 experienced assemblers put the 1,080 trusses together, starting delivery two weeks ahead of the seven-week schedule and keeping well ahead of the job. Assembly was done with the trusses laid horizontally on "horses" and followed an exact erection drawing as might be done in a steel fabrication shop.

After assembly the trusses, some of which weighed four tons, were loaded six to a flat car, and transferred by rail about three miles to the site of the work. Permanent tracks previously had been laid along each side of the warehouses and from this point locomotive cranes handled the trusses. The cranes were equipped with 70 or 80-ft. booms and an added counterweight. They were able to set the 60-ft. transverse trusses in the outside bays of the building and to swing the 40-ft. longitudinal trusses beyond the center of the bay so that a crawler crane could pick them up and set them in place as it backed down the center aisle. The crawler crane also set the 60-ft. transverse trusses in the plan location over the center aisle. The brickwork of the outside wall was erected only up to the level of the bearing for the bottom chord of the truss to facilitate swinging the trusses into position.

Sloped floors save earth moving

The elevation of the floor of each warehouse was determined by the grade that best met the railroad grade and required the least earthmoving. The buildings are so large and cover such a large percentage of the whole site area that the above conditions could be met best by sloping the floors in both directions. The extreme slope used is 2 ft. across the 180-ft. dimensions and 2 ft. along the 960-ft. side making one corner 4 ft. higher than the one diagonally opposite. The difference in elevation is not especially noticeable as the roofs are made level. The column heights are kept constant for half the length of the building and the pedestal heights are varied at each column to meet the slope requirements and extend to constant-thickness footings carried to solid material.

The columns are designed to provide a seat for the trusses at 14 ft,

above the highest point of the floor. Above this level a smaller reinforced-concrete column extends the height of the trusses to provide a stiffener and support for the transverse trusses in the higher center bay.

Firewalls of concrete block and brick completely shut off the warehouse at 240-ft. intervals except for rolling doors designed to automatically close in case of excess heat. It was necessary to keep open a larger passageway through the entire structure than the door provided for the passage of cranes and transit-mix trucks. Also, it was desirable to complete the firewalls, extending above the building, so that the roofing could be placed. Temporary lintels of precast concrete were set across the desired opening through the firewall and the wall completed above this level. After other construction was completed the opening was filled in to make the wall solid.

Paving within the warehouse was started in longitudinal strips the full length of the structure. This was found to delay the project and plans were changed to pour 40x60-ft. blocks in the outer bays and then to complete the work by paving the center 60-ft. bay continuously. Use of this scheme reduced the forms necessary from 500 lin. ft. to 200 lin. ft. for each 40x60-ft. bay. All concrete was purchased delivered on the job by transit-mix trucks.

In paving the 40x60-ft. area of a bay, temporary wood forms were set along the side in which the work was progressing to assure a straight joint for expansion material used at each column center line. Two screed strips were set at 13-ft. 4-in. intervals and the trucks backed in between them to discharge directly on the ground. The wire mesh reinforcing was laid on the ground and then pulled up into the concrete as it was placed.

Concrete was leveled with hand screeds and was treated with a vacuum process to remove surface water and expedite the finishing and curing of the slab. The surface was worked with an electric-powered, circular disc finisher that was converted to a vane machine for a second pass over the area. Up to 80,000 sq.ft. of paving was laid in a 12-hr. day.

For protection of our country's interests, identification of the site and the personnel on the work must await conclusion of the war.

Fig. 3. Sixty-foot transverse trusses over outside aisles frame level with 40-ft. longitudinal trusses. Over the 60-ft. wide center aisle the transverse trusses rest on the top of the longitudinal trusses.

Fig. 2. Detail of floor ready for the concrete slab. Note precast lintels and columns of brick built into the wall.

Fig. 1. To reduce friction as pipe is jacked into position the excavation at forward end is always a little ahead of the pipe and slightly larger than the pipe's outside circumference.

Jacking a Sewer Under a Railroad

W. S. Harvey
City Engineer, Warren, Ohio

***Contents in Brief**—To extend a 54-in. sewer under five railroad tracks at Warren, Ohio, 148 ft. of concrete pipe was jacked into place. Pipe was made in 4-ft. sections, the first piece of which was equipped with a manganese steel cutting shield. Two 100-ton hydraulic jacks were used and the rate of advancement was 9 in. per hour. The saving resulting from use of the jacking method is estimated at $15.24 per lin. ft.*

IN BUILDING a large sewer the city of Warren, Ohio, saved $2,255 by jacking the outfall section underneath five railroad tracks. Substitution of this procedure for the more common tunneling method avoided the use of extensive timbering, most of which would have had to remain in place. The jacking method also eliminated the danger of track settlement and resulted in considerable saving in time and excavation.

The sewer consists of 4-ft. sections of heavily reinforced-concrete pipe each weighing 2.1 tons with a 5½-in. thick shell and tongue-and-groove joints. The pipe was forced through a clay soil having a high percentage of gravel with the average overburden about 14 ft. No water was encountered in the 148 ft. jacked into place. The method of jacking was as follows:

On the east side of the railroad tracks and 6 ft. from the end of the ties a pit 13 ft. long, 10 ft. wide and 11½ ft. deep (Fig. 4) was sunk and tightly sheeted. The back or pressure side of the pit then was built up with three layers of horizontal and vertical 6x6-in. timbers laid solidly and securely bolted. Three 96-lb. railroad rails extending vertically from the top to the bottom of the pit next were place against the back wall. One rail was on the center line of the pipe and the two outside rails coincided with the pipe's walls at the horizontal diameter. The pit was kept dry by draining to a sump and pump located on the outside of the pit.

Next, two railroad rails about 9 ft. long were placed in the bottom of the pit with the top of the rails at the proper elevation to receive the sewer pipe on the continuous flow line. These rails were placed 24 in. apart, parallel to and equidistant from the base line from which the sewer alignment was given. The rails then were embedded in an 8-in. thick concrete slab forming the bottom of the pit. The purpose of embedding the rails in the slab was to make available a sufficiently strong and rigid foundation upon which to do the jacking.

Installation of the first section of the pipe was now possible. This section was provided with a manganese steel plate ½ in. thick and 18 in. wide that formed a shield and cutting edge. This plate, which extended completely around the pipe's outside circumference and 4 in. beyond the pipe's tongue, was securely bolted in place

by five ⅞-in. bolts with their heads welded to the plate and cut off flush. The shield also was fastened to the tongue of the pipe with twelve clips welded to the plate.

When the pipe carrying the cutting shield had been lowered into the pit it was properly centered and blocked up by 12x12-in. timbers placed horizontally between the base of the jacks and the back or pressure side of the pit. Another 12x12-in. timber was placed horizontally between the heads of the jacks and a timber frame fitting the groove of the pipe to distribute the pressure evenly throughout the full circumference of the pipe. The two 100-ton hydraulic jacks then were extended, and when their plungers had reached their full limit, a 12x12-in. timber spacer was inserted and the jacking continued until the 4-ft. length of pipe had been forced forward to its full length. Next the blocking was removed, the heads of the jacks moved back, and another pipe lowered into position. The blocking, jacks, and frame were reset and the process repeated.

During the jacking operation the soil in front of the cutting shield was excavated by hand (Fig. 1) and removed with wheelbarrows through the pipeline to the pit. In the jacking process a few large boulders were encountered, and these were readily removed whole or broken up with an air drill.

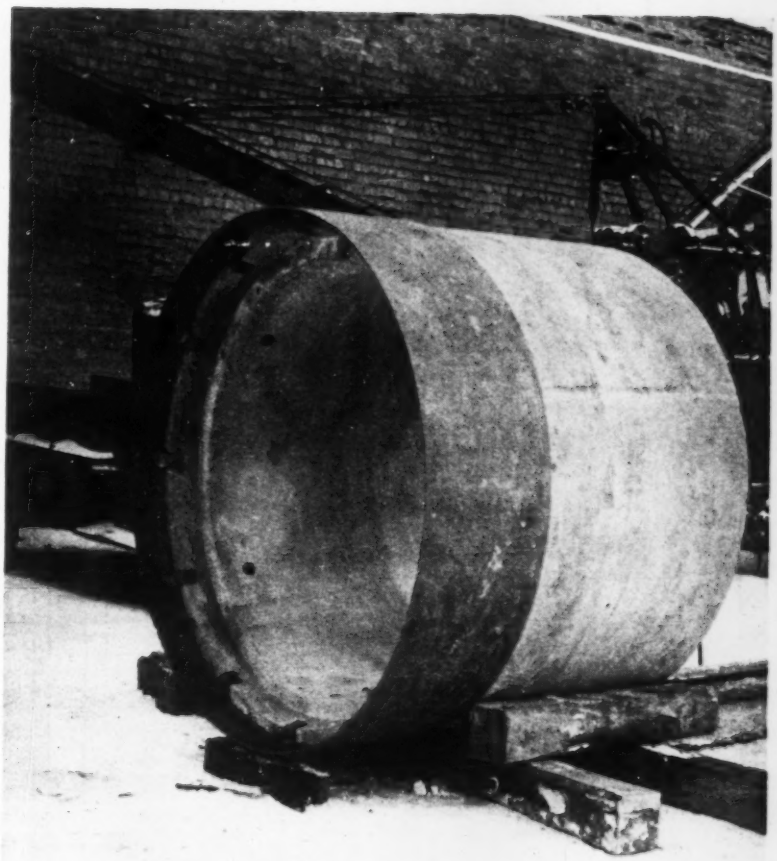


Fig. 2. First section of the 54-in. pipe with the ½-in. thick manganese steel cutting shield attached. Five bolts and twelve clips hold the shield in place. The reinforced concrete pipe, with 5½-in. thick wall, was subjected to a total pressure of 160 tons applied by jacks.

Controlling the pipe's direction

Control of the direction of the pipe was accomplished by shifting the positions of the jacks and by varying the amount of excavation around the circumference of the pipe. For example, if it was found that the pipe was curving off to the left, the jack on that side was extended more rapidly than the other and more dirt was taken out on the left side. In the same way if it was found that the pipeline was curving down, the jacks were lowered to put a greater pressure on the bottom of the pipe and less earth was excavated at the top than at the bottom of the shield.

Sewer alignment was checked from time to time by extending the base line laid down in the pit bottom in a manner similar to that carried out from a shaft in tunnel work. The grade of the flow line was checked by levels taken on the inner top of the pipe section.

There was very little difficulty in

Fig. 3. Two 100-ton hydraulic jacks pushing against a timber frame at the end of the pipe forced the pipe forward. The jacks rest against a 12x12-in. timber placed in front of three vertical railroad rails visible at the back of the pit. W. S. Harvey, city engineer, is at the left.

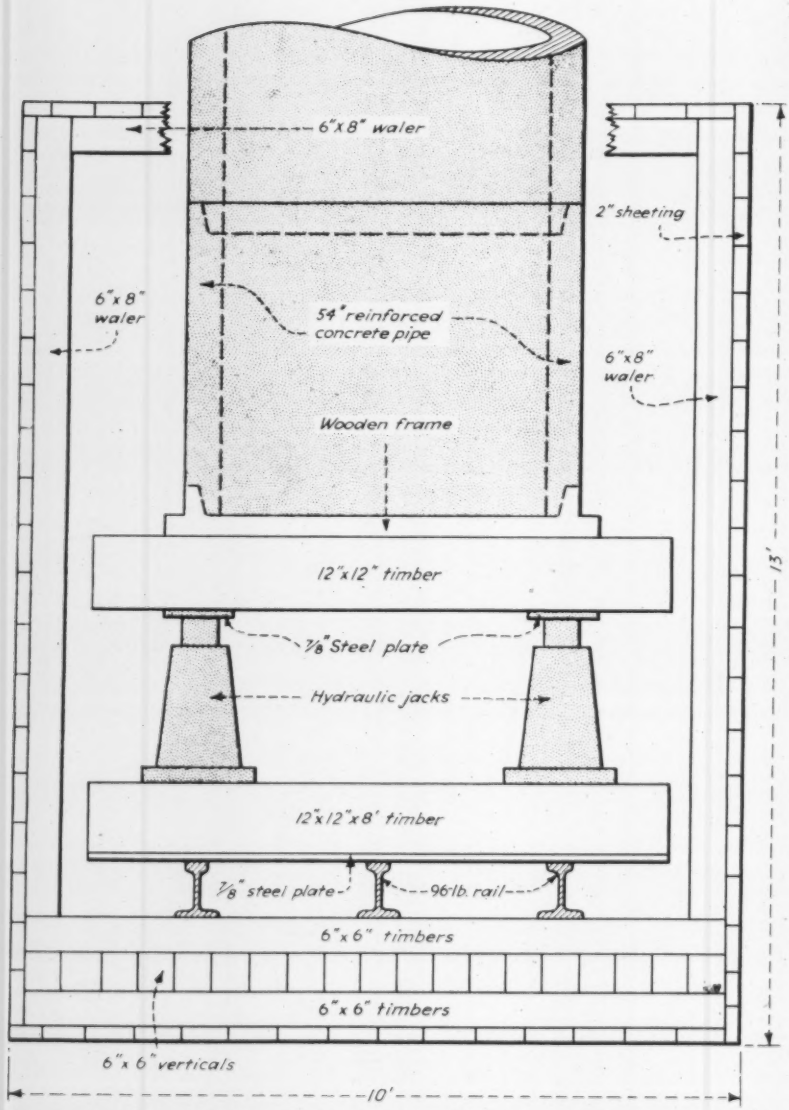


Fig. 4. Plan view of jacking pit showing location of jacks on previous page.

controlling the pipeline for the first 40 ft., after which the excavating at the shield needed to be watched closely when operating the jacks in order that the pressure exerted would control the movement horizontally and vertically.

In order to insure as perfect a bearing as possible for the full circumference at each tongue and groove joint, the slight imperfections were taken up by small hardwood wedges and tar paper. This proved very effective as no serious chipping at any of the numerous joints occurred.

Excess excavation

Excavation at the circular cutting shield at the face was made slightly larger than the outside circumference of the pipe in order to reduce the friction when the pipe was moved forward. If this had not been done, the friction alone, which was estimated at 377 tons, coupled with the added dead weight of the line (78 tons for the full length), would no doubt have caused a shearing at the pipe joints if sufficient jack capacity had been added to extend the sewer. The greatest force actually exerted by the jacks was about 160 tons.

The work of jacking and excavating continued in three eight-hour shifts with an average progress of 9 in. per hr. The labor cost was $4.31 per lin. ft. of pipe placed, including the cost of handling the timbers, lowering and setting the pipes, jacking, excavating at the shield, wheeling the soil from the heading to the pit, and removal of the excavated material to the surface.

The cost of building the sewer by tunneling, including excavation, removal of the earth, timbering, laying the pipe in the tunnel, and backfilling, was estimated at $19.55 per lin.ft. Thus, the jacking method saved $15.24 per lin.ft. or $2.255 in all for the 148-ft. section.

The work is part of a $1,500,000 WPA project calling for the construction of seven trunk sewers. All engineering work, including that just described, is under the direction of the writer.

Nevada Runoff Forecasts

SNOW SURVEYS of the 1941-42 winter season in Nevada warrant a forecast of stream flow for 1942 somewhat above normal, according to the April report of the Nevada Cooperative Snow Surveys. The snow survey indications of Feb. 1 and March 1 were, in general, above the normal expectations for these dates, but deficient precipitation during March changed the situation slightly. In October and November of 1941, the precipitation was somewhat below normal at most of the mountain stations, but December was very high in both rain and snow. The priming of the soil by the early December rains should increase the snow runoff on the surface.

Stream flow in Nevada during the summer of 1941 checked very well with the forecasts based on snow surveys. Exceptions were the rise of level in Lake Tahoe and the runoff of the East Walker drainage area, both of which were considerably higher than the forecasts. This difference is attributed to excessive spring precipitation in high altitudes on these drainage areas. Thus, the water content of the snow, as shown by the surveys of May 1, was higher than that shown by the surveys of April 1, while usually there is a drop in water content during April. The report states that several high-altitude snow surveys by the California Cooperative Snow Surveys also showed an increase in water content during April 1941. The Nevada forecasts for June 1941, ranged from 76.1 to 97.8 percent of normal runoff from different drainage areas, while the actual runoffs ranged from 76.03 to 123.9 percent.

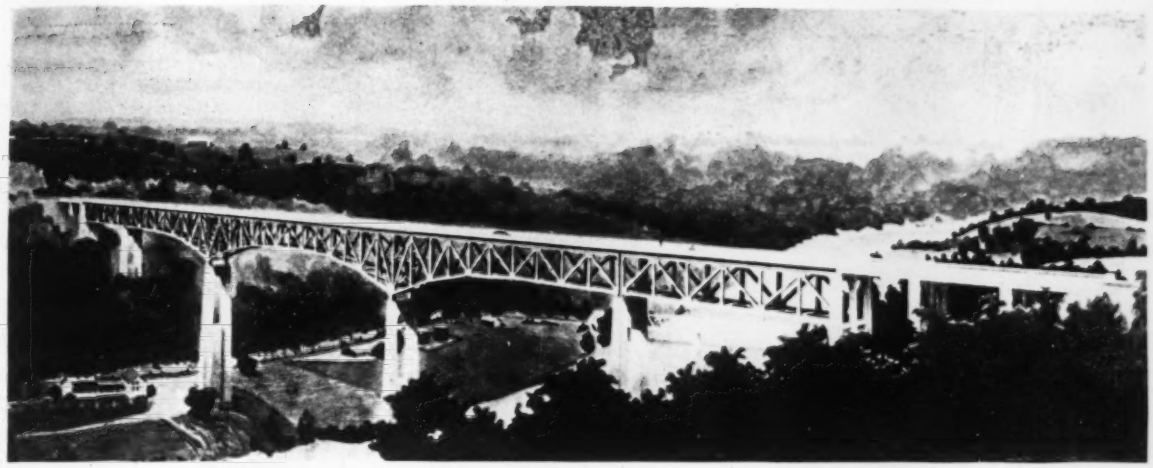


Fig. 1. The new bridge to carry U.S. Route 25 over the Kentucky River will have its deck 250 ft. above water level.

Kentucky Builds a High Bridge

E. D. Smith
Assistant Bridge Engineer, Kentucky Department of Highways
Frankfort, Kentucky

***Contents in Brief**—Under construction across the Kentucky River is a highway bridge that will be 250 ft. above the water, with a maximum pier height of 198 ft. This pier will be a double column with connecting web wall for the first 90 ft., then two individual columns for 68.5 ft., topped out by a double column joined by a web member for the remaining height of 11 ft. Location and design of piers were based on extensive studies to determine the most satisfactory crossing based on operation and aesthetic requirements. The bridge, which will provide a 26-ft. roadway, will shorten U. S. 25 by 1.50 miles, eliminate six curves and 8,000 ft. of 7-percent grade.*

HIGHEST HIGHWAY BRIDGE east of the Mississippi River will be the new Kentucky River crossing of U. S. 25 at Cleveland, Ky., with a design height of 250 ft. above normal pool level. The structure will replace an existing wrought-iron bridge built in 1869 and eliminate several steep grades and dangerous hairpin curves (Fig. 2). Located in a scenic region of the state and crossing a magnificent gorge, the highway department considered the architectural treatment of the bridge before the structural design was carried out. Final design provides a central portion consisting of a three-span, continuous, Warren deck truss with a 448-ft. center span and 320-ft. side spans (Fig. 4). In addition there will be two 192-ft. simple Warren deck truss spans and six 50-ft., reinforced-concrete spans.

The trusses are to be 22½ ft. center to center, with depths of 60 ft. at the main piers and 30 ft. at the center of the central span. Transverse floorbeams on 32-ft. centers will be used on top of the trusses and the longitudinal stringers are spaced at 5½-ft. centers. Permanent, creosoted-timber inspection walks will be placed between the trusses, and these will be at the elevation of the bottom chord members.

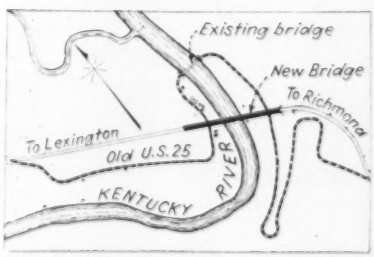
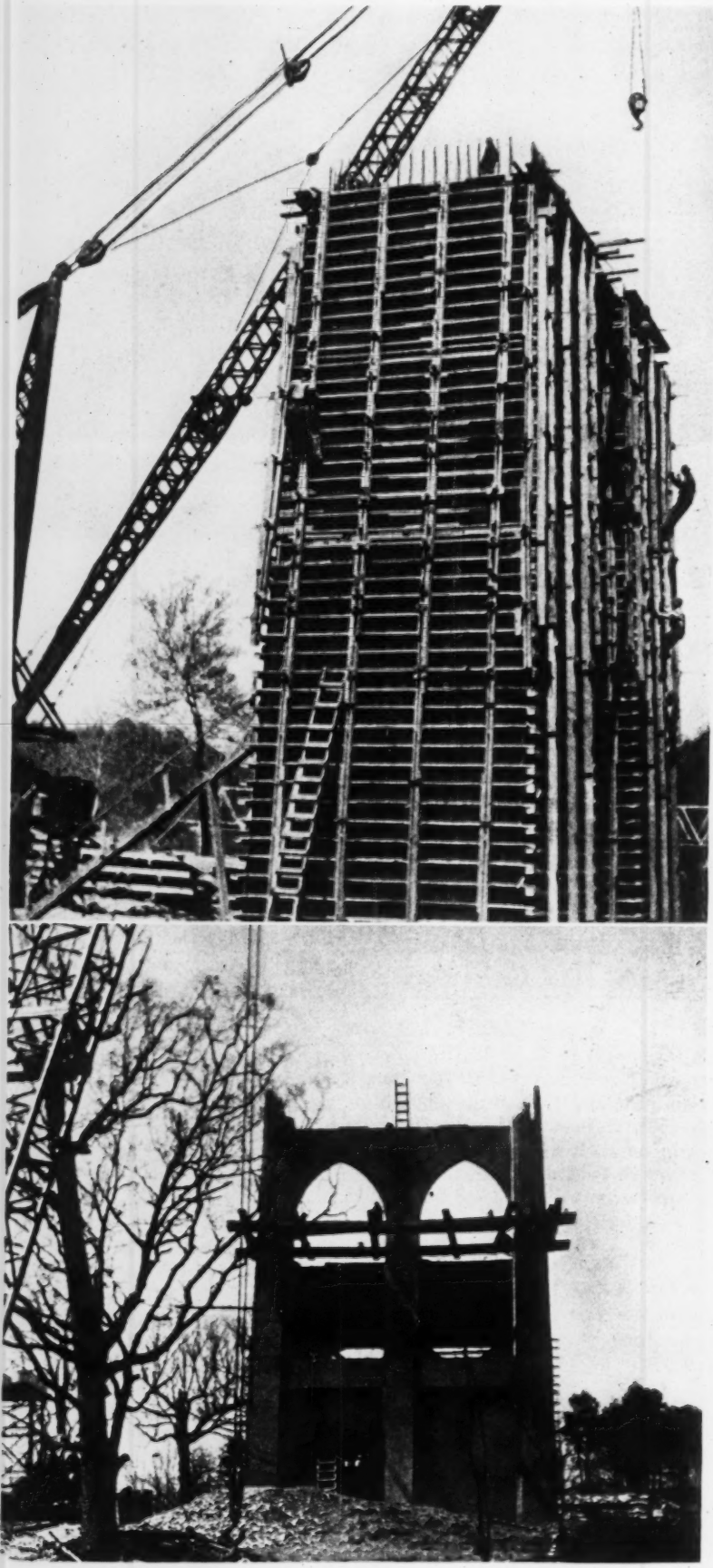


Fig. 2. New crossing will shorten U. S. 25 by 1.5 miles and eliminate several sharp curves. Maximum grade in the vicinity of the crossing will be reduced from 8 to 6 percent.

A 26-ft. roadway and two 3-ft. sidewalks will be provided by a 7½-in. concrete deck. Principal reinforcing for the deck is to be transverse to the direction of traffic and will consist of two layers of ⅞-in. round deformed bars on 5-in. centers. Transverse expansion joints on 32-ft. centers through the length of the truss spans will be provided by 24-oz. soft sheet copper and premolded joint filler. Alternate designs have been prepared for a wrought-iron handrail and a reinforced-concrete rail.

Tall piers required

The substructure will be founded on solid limestone rock and the maximum foundation pressure will not exceed 10 tons per sq.ft. The tallest pier (Pier 6—Fig. 5) will be 198 ft. high from bottom of footing to pier cap and its base will be 30x50 ft. The reinforced-concrete structure will be a double column with a connecting web wall for the first 90 ft. above its base, for the next 68½ ft. two individual columns will be used, and then for the remaining height the columns will be joined by a web



member. This pier will contain 3,800 cu.yd. of concrete.

The next tallest pier, Pier 5, is 181½ ft. high, while the shortest of the piers for the three-span, continuous-truss, central unit is the 85-ft. Pier 7. All the piers, including those for the approach truss spans, are of similar design. The approximate quantities of materials for the entire bridge will be 2,250 tons of structural carbon steel containing 0.2 percent copper, 600 tons of reinforcing steel, and 12,500 cu.yd. of concrete.

Designed for H-20 loading

The crossing is designed for an H-20 loading in accordance with the 1935 specifications of the American Association of State Highway Officials. In design of the three-span, continuous-truss unit the method followed was that outlined in *Movable and Long Span Steel Bridges* by Hool & Kinne, first edition.

The general contractor will be required to weigh with hydraulic jacks the dead-load reactions of the continuous truss to permit comparison of the calculated and actual forces.

The steel spans will be cambered for dead load only. The calculated deflections were obtained by means of the Williot-Mohr diagram, which indicated an expected 3.6-in. dead-load deflection at the center of the 448-ft. span and 2.2 in. at the center of the 320-ft. side spans. The maximum live-load deflection for the central span is expected to be 1.3 in., while that for the side spans is estimated at 0.8 in.

Construction procedure

The cofferdam for Pier 6 was constructed of 50-ft. steel sheet piling with the three lower tiers of wales and struts of steel and the other tiers of timber. A fault in the hard underlying limestone rock extends over the entire footing area and the rock is in 24-in. thick strata that dip at about an angle of 45 deg.

Two 4-in. pumps kept the cofferdam unwatered and the concrete was placed in the dry by a derrick with a 150-ft. boom supported on timber

Fig. 3. Forms for the lower part of Pier 6, which will be 198 ft. high, are shown in the upper view. They are set with the 150-ft. boom of a derrick set on high falsework. Details of this pier are shown in Fig. 6. The lower view shows the type of piers, this being Pier 8, one of the shorter piers.

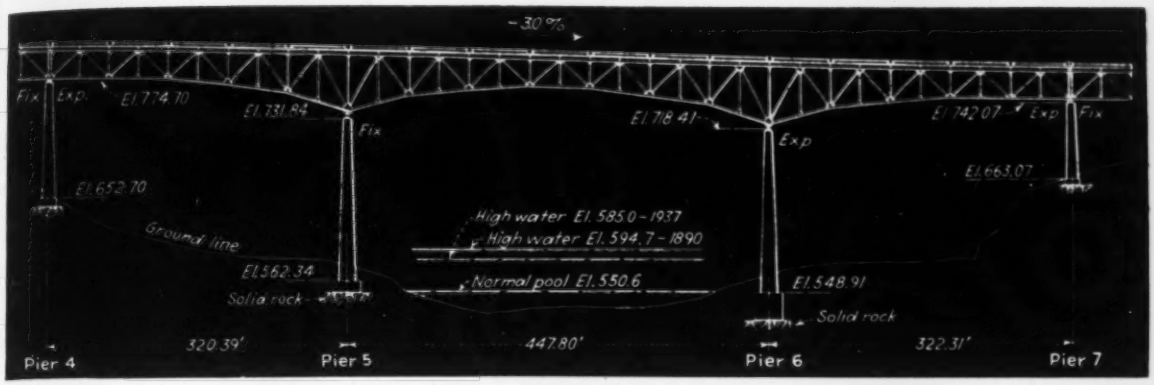


Fig. 4. Central portion of bridge is a three-span continuous truss with a 448-ft. center span and 320-ft. side spans. In addition, there will be two 192-ft. steel spans and six 50-ft., reinforced-concrete and girder units.

piling 10 ft. above the ground. This derrick will be used in placing concrete for the other tall piers.

The bridge's substructure is being built by the Massman Construction Co., Kansas City, Mo., at an estimated cost of $345,800, and the Mount Vernon Bridge Co., Mt. Vernon, Ohio, has a $465,000 contract for fabricating and erecting the steel superstructure. Bids will be opened this summer for construction of the concrete deck and the reinforced-concrete approach spans. The total cost of the bridge will be about $900,000, or $20 per sq.ft. of roadway. Due to the war, no completion date has been set, but the foundation work was 39 percent complete at the end of April.

Austin Griffith of the Kentucky Department of Highways and his bridge squad designed and prepared plans for the structure under the writer's supervision. J. Lyter Donaldson is commissioner of highways; Thomas H. Cutler, state highway engineer; G. L. Logan, director of construction; H. R. Creal, bridge engineer; R. W. Tripp, chief location engineer; W. W. Pardon, district engineer; and T. J. Hopgood, resident engineer. Mack Galbreath, senior highway engineer for Kentucky, is representing the Public Roads Administration, which is supplying one half of the cost.

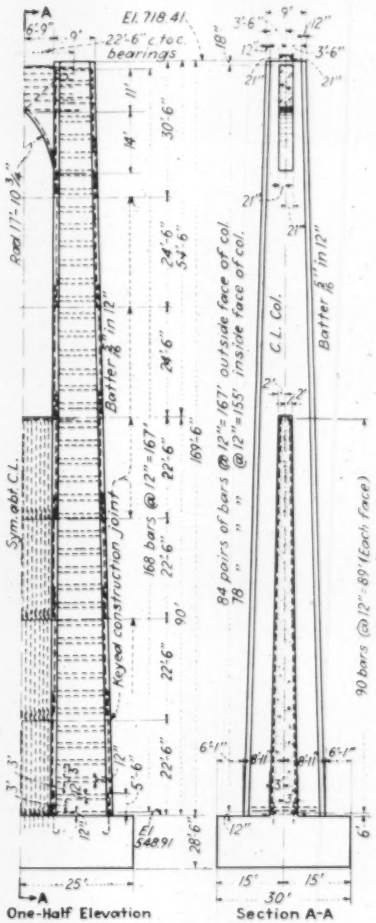


Fig. 5. Pier 6, will be 198 ft. high and will require 3,800 cu.yd. of concrete and 172,000 lb. of reinforcing steel.

Mexico Expands Its Railway System

THE Republic of Mexico now has two railroad projects underway that together total 800 miles of construction, according to the Mexican federal railroad department. The longest is the 465-mile Puerto Mexico-Compeche project in southeastern Mexico. The two terminals are both Atlantic seaports, Puerto Mexico being in the State of Vera Cruz and Campeche being the capital of Campeche State. This line is mountainous construction and is scheduled for completion in 1949.

The second project is 335 miles in length and is in the level desert country of northwest Mexico. This work, known as the Sonora-Baja California line, is scheduled for completion in 1945.

Completed railroads in Mexico total 14,100 miles, including 11,425 miles of standard gage track and 2,675 miles of narrow gage. In all 10,090 miles are operated by the federal government, the remainder being operated as private enterprise.

For new construction, steel rails are imported only when not available from the mills at Monterrey, the capital of Nuevo Leon State in northeastern Mexico. However, considerable of the steel must be imported for the bridges, especially those structures requiring wide plates, as Mexican mills produce no plates wider than 18 in. It is also necessary to important silicon steel members, since this steel is not manufactured commercially in Mexico.

Some indication of the rate of steel importation for railroad work can be gained from the fact that during 1940 the United States supplied 86 tons and a 220-ton shipment was obtained from Germany to complete a 1,460-ton German order. The German steel was for the Marques Bridge on the 80-mi. Caltzontzin-Apatzingen line, which is in southeastern Mexico, and was placed in service early this year. During 1942 some 1,000 tons may be imported from foreign sources.

Locomotives and rolling stock are purchased from manufacturers in the United States.

Federal employees engaged in railroad work include: 126 civil engineers, 28 in the medical service, 2,342 laborers, and 277 miscellaneous employees. Railroad contractors also employ large staffs.

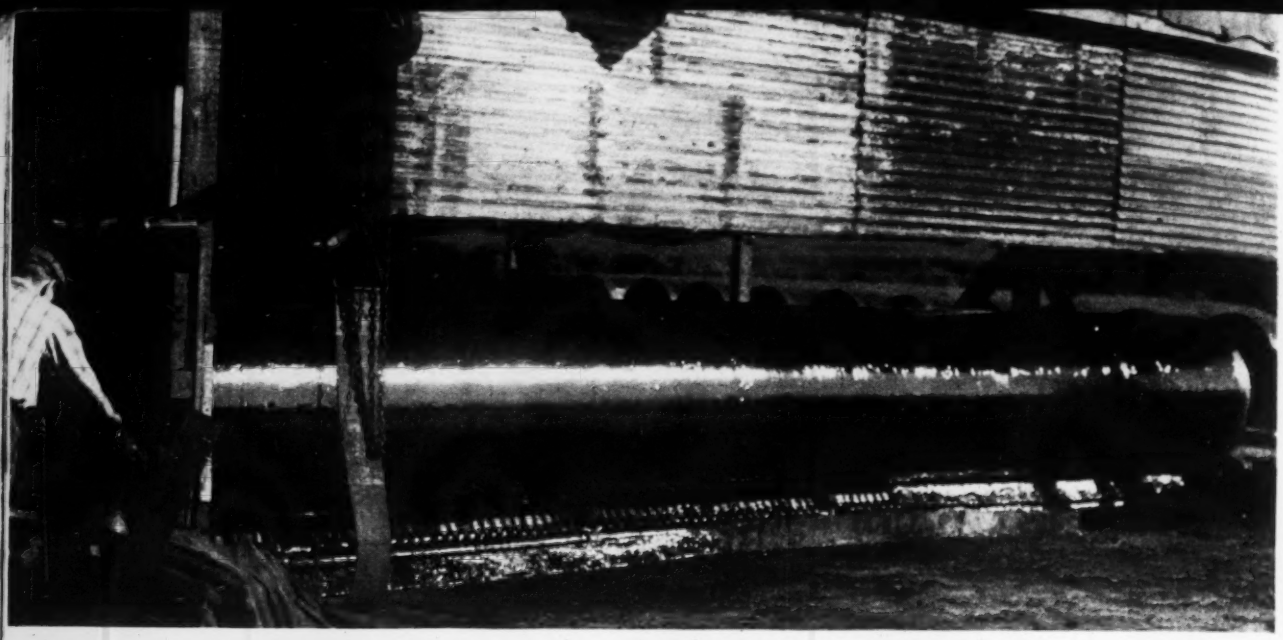


Fig. 1. The pipe spinning rig had gas burners on the underside for heating the metal.

Pipe Protection with a Thin Enamel Coat

John J. Crowley
Civil Engineering Inspector San Francisco Water Department

***Contents in Brief**—The San Francisco water department recently relaid some 9,300 ft. of 44-in. steel pipe on which coal tar enamel protection was spun on in thicknesses as low as 1/32 in. No primer coat is used for enamel applied in this way; cooling with a combined air blast and water spray improved control of the lining operations.*

About 9,330 ft. of 44-in. steel pipe in the San Francisco water system recently has been reconditioned and relaid with new lining and coating of coal tar enamel having a minimum thickness of $\frac{1}{32}$-in. This reduction from the usual thickness of $\frac{3}{32}$ in. is the outcome of experiments extending over a considerable period of time. Methods now in vogue in San Francisco use the hot-plate process for bonding the protective enamel, thus doing away with the primer coat formerly required. Another departure from previous standards, in the relaying of this 44-in. line, was the substitution of hand methods of cleaning for the usual practice of cleaning with a sandblast.

The hot-plate process was particularly well adapted to the recently completed work because of the necessity for doing it during the winter months in an exposed location. The job thus constitutes an example of the effectiveness and accurate control of methods by which it is possible to apply the protective material in layers as thin as $\frac{1}{32}$ in.

The pipe involved in this operation consisted of steel plates $\frac{1}{4}$ and $\frac{5}{16}$ in. thick with two welded longitudinal seams to each pipe section. As originally laid, the pipe was in 30-ft. sections with welded bell and spigot joints protected by an asphaltic dip that was covered with a rag felt wrapping.

Cleaning operations

As the old pipe was taken from the trench, it was cut in 60-ft. lengths, hauled to the reconditioning yard and there cut into 30-ft. lengths. Saddles and nipples, as well as all excess weld metal and slag, were removed but the bell ends of the joints were left in place for use in relaying.

The rag and asphalt coating was knocked off the pipe by laborers using hammers weighing 3 to 4 lb. The coating was brittle enough to be removed readily in this manner as long as the temperature remained below 60 deg. F. At higher temperatures the asphalt would be dented and not broken by the hammer blows. Accordingly, this crew was shifted to roustabout work whenever air temperature exceeded 60 deg. F. The outer coating was successfully removed in this manner except for a thin film of asphalt and small isolated patches that had to be scraped from the surface.

Each pipe section was then placed in the spinning machine where it could be rotated while gas burners on the underside heated the metal. A two or three-minute application of heat while the pipe rotated at 8 rpm. brought the temperature up to about 150 deg. F. Then the heat was shut off and rotation was stopped. The lining could then be removed by hand scrapers with minimum effort.

It was found highly important that just the right amount of heat be applied in this operation. Too much heat would renew the bond of the old lining, making its removal more difficult. Too little heat left the asphalt in a brittle condition and each particle would have to be scraped from the surface.

When correctly heated, however, by a relatively large amount of heat applied for a relatively short time, that portion of the lining immediately adjacent to the pipe metal is converted into a semi-fluid condition and the remainder of the asphalt is left unchanged. While in this state, the pressure of scrapers, thrust in parallel to the pipe axis, can be made to peel the lining away from the metal.

The desirable amount and duration of the heat application depends upon (a) air temperature and (b) thickness of the lining. The heating usually must be repeated two or three times for each pipe section because the success of the method depends upon the fluidity of the layer next to the metal. This layer will cool and harden when the heat is shut off, before the scraping operation can be finished. However, with several reheats, the pipe can be cleaned of all asphalt lining except a very thin layer spread on the plate by the heating operation.

From the spinning machine the sections were taken to the cleaning shed for the final clean-up, which was done by hand. In this operation the pipe first was sprayed with a thinner and then hand scrapers, steel wool, wire brushes and rags were used. This treatment usually had to be given twice, after which the only remaining asphalt was in small patches left by rapidly drying thinner. These were removed by final spraying and washing, using naphtha as a solvent and following it with wire brushes and steel wool.

From the cleaning shed, the pipe went to the spinning machine where coal tar enamel was applied inside and outside. This machine, mounted on a concrete base, had a set of two flanged drive wheels at one end and two idler wheels at the opposite end, adjustable to accommodate varying lengths of pipe. The motor drive operated through sprockets adjustable to permit of low speed at 8.7 rpm. (100 ft. per minute peripheral velocity) or 95 rpm. (peripheral velocity 1,110 ft. per minute). Hold-down straps and bolster blocks at each end were necessary to keep the sections from flying off the machine at high speed.

Heat control important

A double row of gas burners set along the entire length of the machine below the level of the flange wheel was divided into five sections, each with a control valve. This was necessary for adjustment of the gas supply in insuring correct distribution of heat. As the ends of the pipe were the most difficult to heat, being more subject to drafts, portable gas burners were used at each end. To give flexibility in protection from exposure to outside air, the spinning shed framework was provided with easily removable sides of corrugated iron and tarpaulin. While pipe sections were being heated, outside air was excluded as much as possible; while the pipe was being cooled, the wind barriers were removed.

Pipe sections were heated to a temperature of 325 deg. F., the time required for this operation varying from four to six minutes, depending on the weather. The desirable high degree of smoothness in the interior lining was found to be dependent upon uniformity in this heating operation. In sections unevenly heated, only excessive spinning time would prevent soft, plastic spots from remaining after other portions of the lining had cooled and set. Even then the surface was likely to be wrinkled, corrugated or even blistered in places.

The coating on the outside of the pipe was applied in two operations. This made it possible to first put on a very thin layer which could be made to effect a good bond with the steel without risk of the flaking off in spots that would occur with a thicker coat at the higher speeds later used for interior lining. Material for the first exterior coat was poured on from buckets and then spread uniformly with hand-manipulated squeegees held against the pipe while it revolved at 8.7 rpm.

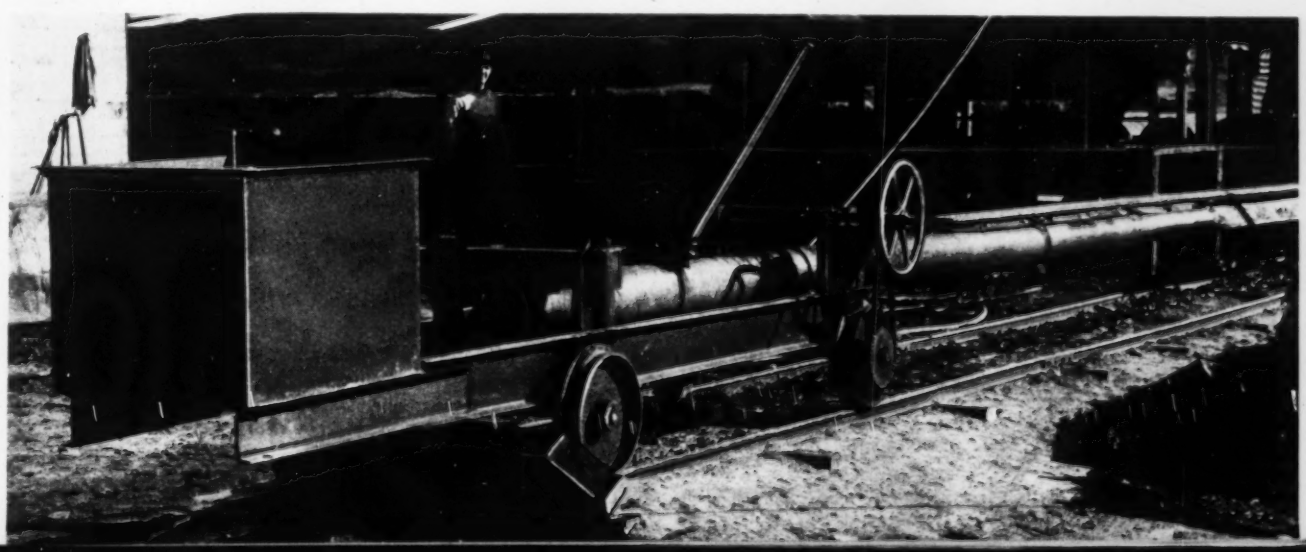
Rotation was then quickly speeded up to 1,100 rpm. and the hot enamel for the interior lining was poured from a heating kettle into the trough. The trough then was tipped slowly, spilling its content along the full length of the trough into the rapidly revolving pipe. When empty, the trough was quickly reversed and withdrawn from the pipe section to prevent enamel drippings from marking the lining.

A blower with a capacity of 2,000 cu.ft. per minute was then started up and its blast of air was directed by a canvas duct into one end of the pipe. After about 30 sec. a jet of cold water was turned on, allowing the water to be spread out into a spray by the air blast. About two minutes of this combined treatment would cool the pipe temperature below 200 deg. F.

Blower was a great advantage

On the first few sections lined, no blower was used and time limits, before the introduction of the water jet, were varied from 30 sec. to as much as four minutes. Despite all variations in treatment routine, until the blower was put in results were not very satisfactory. Most of the lining was smooth enough, but it was difficult to avoid corrugations and the

Fig. 2. A trough 30 ft. long dumped enamel simultaneously on the entire length of the pipe interior while it was spinning.



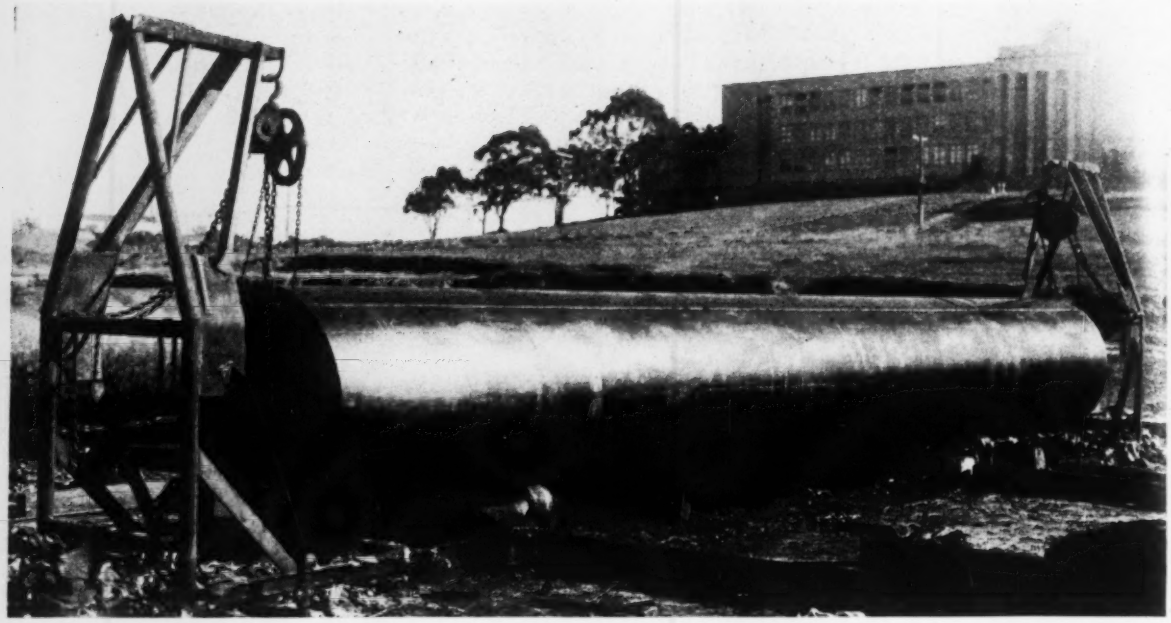


Fig. 3. This cleaning rig, with shop-made supports, was used for heating the sections prior to removing old asphalt lining.

greatest care, including frequent adjustment of burners and positions of the windbreaks, was necessary to obtain even passable results. A common defect was the frequent appearance of large wash and ripple marks caused by the cooling water washing back and forth as the pipe revolved.

The blower made a very great improvement. With it not only could the spinning time be cut from four to two minutes, but the operation was of a far less critical nature, fewer heat and windbreak adjustments were required, the entire process could be controlled more easily, and there was a much better finish in the lining.

In addition to reducing the heat of the metal uniformly and quickly, the strong air flow kept the cooling water moving steadily through the section, thus eliminating the wash marks and corrugations resultant from water free to whirl with the pipe. Also, the fine spray resulting from the air blast, eliminated pock marks previously caused by water drops striking soft enamel.

After the sections were cooled from the 325-deg. F. lining temperature to below 200 deg. F., rotation was slowed down to the 8.7 rpm. rate and the final coating was applied outside over the first coat already mentioned. The second coat, put on by the same method, brought the thickness up to $\frac{1}{32}$ in.

The usual spark-gap flaw detector, used on finished pipe sections, showed the enamel coverage to be very good except along the weld lines where pinholes occasionally were found. These were given a brush coat of enamel.

Tests showed that linings, applied as described, had thicknesses ranging from $\frac{1}{32}$ in. to $\frac{5}{64}$ in., the average being $\frac{3}{64}$ in. About 60 percent more material was used than the amount needed, theoretically, for the minimum thickness. This overage was largely accounted for by thickened lining in certain zones. For example, a thickness of $\frac{5}{64}$ in. normally was found in a narrow strip lengthwise of the pipe about a foot from the longitudinal welds. This thicker area always occurred on the forward side of the moving weld, i.e., the weld acted as a dam retarding the flow of the enamel which, being of high viscosity, piled up here, cooled and set in that location. From this strip the thickness of the lining reduced uniformly in a circumferential direction to the specified thickness.

Although the thickness of the lining at the ends of the pipe (and for 2 to 3 ft. within) was close to the $\frac{1}{32}$-in. objective, the finished lining thickened steadily toward the middle of the pipe. This thickening is attributed to a sag in the trough sufficient to cause a greater accumulation of enamel in the middle.

Of the 150 lb. of enamel used for each pipe section, 58 lb. was in excess of the theoretical requirement for a $\frac{1}{32}$-in. thickness. Of this excess, about 10 lb. was chargeable to unavoidable waste in the trough, etc., about 20 lb. was in the two zones where the action of the welds as dams caused thickening, and the remaining 28 lb. was in the central section resultant from the sagging trough.

To explore the possibility of further reducing costs, experiments were made with coal tar pitch in place of the enamel. Two sections of pipe were treated with pitch at a penetration of 7 at a temperature of 77 deg. F. This corresponds to the penetration of the enamel used in the lining operations described.

In appearance, smoothness and bond, the two pitch-treated sections were the equal of those covered with enamel. However, the pitch had a tendency toward brittleness. Laboratory tests, although too few to be conclusive, suggested that this brittleness might be overcome by raising the penetration; with penetrations of 11 to 13 at 77 deg. F., the pitch might meet the same test requirements as the enamel.

Since development of the hot-plate process (patented by O. G. Goldman, assistant superintendent, San Francisco water department), it has been used to the complete exclusion of the old primer method of bonding protective coatings to steel pipes laid in San Francisco.

Reconstruction of the pipeline was under contract to M. J. Lynch; that part of the work involving the reconditioning of the pipe was carried out under subcontract to A. R. Reid Co.

Heavy Load Tests on a Plywood Girder

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***Contents in Brief**—Tests on an 18-ft. plywood girder designed for the heavy loading used in highway bridge design were conducted recently in the civil engineering laboratory of Carnegie Institute of Technology. Results of the tests are given, with conclusions as to principles to be applied in the design of plywood girders for such loadings when assembled with ring connectors for actual service in the field.*

WARTIME SHORTAGES of structural steel have led to the substitution of wood and plywood for many structural purposes, but due to lack of design information few, if any, attempts have been made to extend substitution into the field of heavy load-carrying girders. This article presents the principal results of tests on an 18-ft. girder constructed largely of plywood and assembled with ring connectors. The girder was designed for the H-15 loading of the American Association of State Highway Officials.

Design assumptions were a floor having a dead load of 600 lb. per lin. ft. of girder. One half the H-15 live load was assumed to act on one girder. The following design stresses were used:

Shear perpendicular to face plies of plywood	240 psi.
Douglas Fir in tension or compression	2,000 psi.
Load on connector ring in pounds per ring (Minimum value for load at 90 deg. to grain assumed due to uncertainty of direction of grain in plywood)	1,960 psi.

It was assumed that the web would take shear but no moment. Splices were designed for shear only. These assumptions made the girder heavy in appearance and the test results indicate that they were too conservative.

In order to determine the results of strain gaging, the properties given in the accompanying table were determined experimentally, each value representing the average of two specimens.

Material	Modulus of elasticity, pounds per square inch		Proportional elastic limit, pounds per square inch	
	Tension	Compression	Tension	Compression
Douglas Fir	2,860,000	2,280,000	5600	4300
Plywood* (parallel to the face grain)	1,100,000	1,460,000	1000	2500
Plywood (perpendicular to face grain)	780,000	1,100,000	1000	1400
Plywood (at 45 deg. to face grain)	280,000	225,000	600	850

*All plywood of Douglas Fir

Plywood test specimens used to obtain these values were made up of three thicknesses of $\frac{5}{8}$ in. Douglas Fir plywood glued in the same way as the girder web.

Fabrication of the girder

As shown in Fig. 1 and 2, the web was constructed in three 6x4-ft. sections, with splices at the third points. Each section was made up of three layers of $\frac{5}{8}$-in. thick plywood glued together with a water-soluble "waterproof" type of glue under a pressure of 150 lb. per sq.ft. and nailed 6 in. on centers. Flanges and end stiffeners were made of 4x6-in. (S4S) Douglas Fir. Intermediate stiffeners of 4x4-in. (S4S) Douglas Fir were placed at the midpoint of each panel. Splice plates, 4x10 in., were made up of six layers of plywood glued together in the same way as the web material.

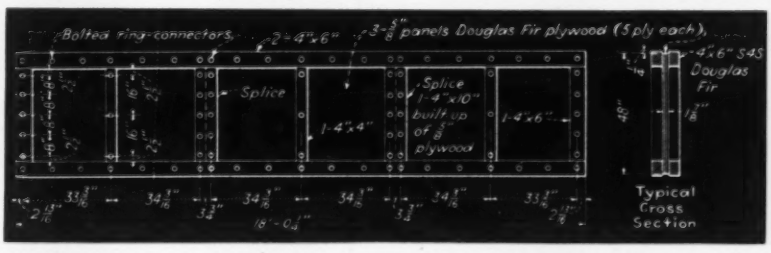

Fig. 1. Elevation and section of the plywood girder subjected to test. The web is of three layers of glued 5/8-in. plywood. Splices at the third points are also of plywood. Flanges and stiffeners are of Douglas Fir. Split-ring connectors and bolts were used to assemble the girder.

All connections were made with 2½-in. split-ring connectors using ½-in. bolts 10 in. long. A minimum edge distance of 2½-in. was used for the connector rings.

Each part of the girder was individually laid out, drilled and grooved and then assembled into the complete unit. The stiffeners and splice plates were finished to exact length and driven into place. All material was structurally sound and free from defects.

Strain-gage lines

A total of 177 strain-gage lines were placed on both sides of the girder at various points to determine the flange stresses, web buckling stresses, stiffener stresses, transfer of stress from the web to the flanges, and the general efficiency of the design. Gage holes were drilled in surveyor's tacks which had been driven into the girder at the proper points. A 10-in. Whittemore strain gage was used to obtain the stresses, and dials reading to one thousandth inch were used to obtain deflections. The locations of the gage lines for one side of the girder are shown in Fig. 3.

Three loading conditions were studied, *i.e.*, at the stiffener over the end bearings, at the third point, and at the center line. Load testing at the center point was continued until failure occurred. For the end stiffener test, load was applied through a spherically seated head 10 in. in dia. bearing against a ½-in. steel plate covering the top flange immediately over the stiffener. A length of eight inches of the lower flange was supported on a similar plate. Shims ¼ in. thick were placed between these plates and the web. Fig. 3 shows the results of this test for a load of 22,500 lb. The

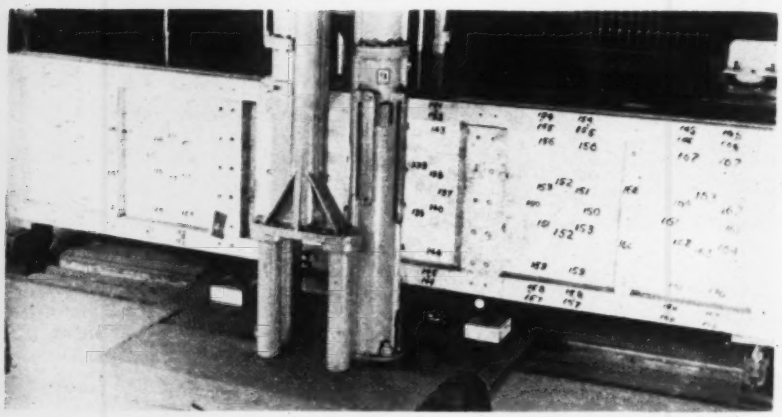

Fig. 2. Girder in the testing machine. Its span center to center of bearings is 18 ft. Splices are at the third points.

strain gage readings indicate that the web took most of the load. Gage lines at the center of the end panel showed no stress except in the vertical direction where a compressive stress of 100 psi. was measured.

Splices lacked rigidity

For the third-point loading condition, a total load of 28,800 lb. was applied at the third-points of the top flange through one-inch rollers set on steel plates. Each end of the girder rested on heavy steel plates set on rocker type supports. No lateral bracing was used. The end bearing area was about 75 sq.in. for each support. Measured deflections for this loading condition are shown in Fig. 4. The deflection pattern shows that the splices apparently lack rigidity, permitting the girder to deflect as three separate parts. Thus, the deflection at the center line, which is at the center of the intermediate panel, and the deflections at the third points are approximately the same. Representative measured stresses are shown in a portion of Fig. 3. A study of that figure shows that in the main there is integral action between the component parts of the girder. The splice plates, however, are stressed only a small amount and most of the other members could safely be reduced in size without surpassing the unit stresses used in the design.

Center-point load tests

For the center-point loading test, load was applied through a steel plate, bearing on the top flange and having 150 sq.in. of bearing area. The same end condition was used as for the third-point test and no lateral bracing was employed. Deflections measured under the center-point loading are shown in Fig. 4. Within the design range of 21,600 lb., the deflection pattern was much the same as that obtained under the third-point loading with slightly more deflection at the center line. Even with this condition, the girder deflected as three separate units, again indicating lack of rigidity in the splice plates. Stresses measured for the 21,600-lb., center-point load are shown in a portion of Fig. 3. Again, integral action is apparent although most of the members are understressed.

Under a load of 50,000 lb., a few gage lines were read and a maximum stress of 530 psi. was observed at the tensile 40-deg. line in the panel to the right of the center line. Both the compressive and tensile diagonal stresses in all of the panels were equal to this value for the 50,000-lb. load. The maximum vertical stress in the web immediately over the supports was 1,450 lb.

The girder failed by lateral buckling at a total load of 110,380 lb., the maximum deflection under this load at the center line being 2.75 in. Buckling was induced by a compression failure perpendicular to the grain in diagonally opposite ends of the lower flange. When these portions failed by crushing, they permitted the top flange to deflect horizontally at the ends, causing lateral buckling. When the load was released, the girder recovered considerably, the permanent set after the removal of load being 0.35 in.

An examination of the girder after failure showed that the wood cores of the split-ring connectors in the section immediately over the support had sheared off and caused the edge material to tear out also. Apparently the edge distance of 2½-in. for the plywood was too small for this overload.

Conclusions from the test

The following general conclusions may be made as a result of these tests:

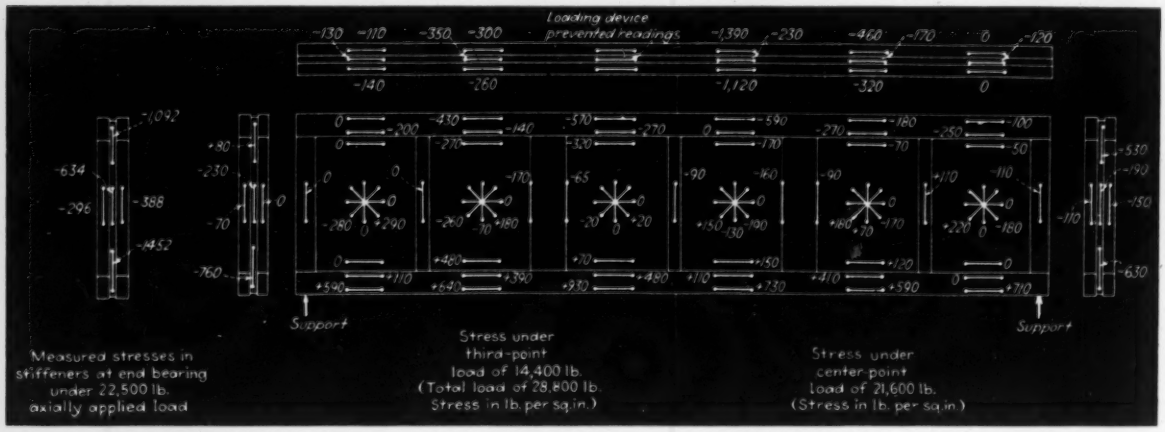
Loading device prevented readings
Support
Support
Measured stresses in stiffeners at end bearing under 22,500 lb. axially applied load
Stress under third-point load of 14,400 lb. (Total load of 28,800 lb. Stress in lb. per sq.in.)
Stress under center-point load of 21,600 lb. (Stress in lb. per sq.in.)

Fig. 3. Measured stresses in the girder. At the extreme left are shown the stresses in end stiffeners under an axially applied load of 22,500 lb. Shown on the girder face at the left center are stresses under third-point loads of 14,400 lb., and at the right are those produced by a center-point load of 21,600 lb.

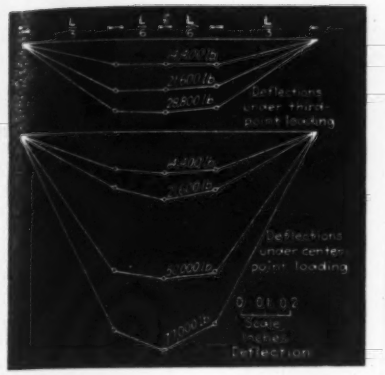

Fig. 4. Deflections of the plywood girder under third-point and center-point loading.

1. The plywood web took moment in approximate proportion to the number of longitudinal plys. A design made on this assumption would reduce the size of the flanges and permit a better utilization of the allowable working stresses.

2. Much of the deflection came from lack of rigidity in the splices. A girder made of one continuous panel might therefore be expected to show less deflection under the same loading.

3. An edge distance of at least 3 in. should be used for 2½-in. split-ring connectors in plywood.

4. Properly designed and constructed girders of plywood may be expected to resist heavy loads with reasonable deflections and satisfactory working stresses.

Acknowledgment

The author wishes to acknowledge the valuable work of J. T. O'Brien and A. J. Karpinski, formerly students in the Department of Civil Engineering of the Carnegie Institute of Technology, who carried out these tests as a thesis problem under the supervision of the author, also the valuable advice of Prof. F. J. Evans in selecting the proper design. Acknowledgment is also due to the Douglas Fir Plywood Association and the Hal Keely Plywood Co. of Pittsburgh, which furnished the plywood and much valuable advice, the Timber Engineering Co., which furnished the split-ring connectors and the West Coast Lumberman's Association which furnished the Douglas Fir.

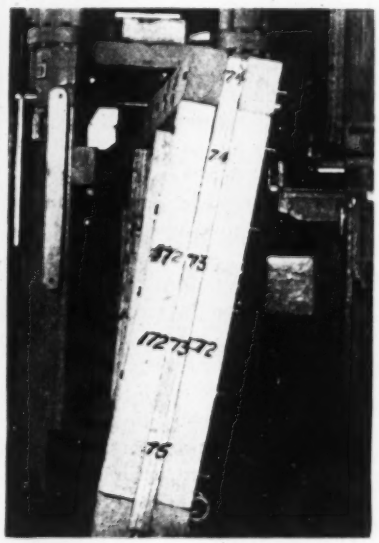

Fig. 5. End view of the girder after lateral buckling under a load of 110,580 lb. The design load was 21,600 lb.

Water Volume in Partly Filled Tunnel

Louis J. Sack
Board of Water Supply, New York

When unwatering a tunnel it is often important to know the volume remaining at various stages. For a partially filled, graded tunnel the computation of the quantity is ordinarily rather laborious, but the writer on the Delaware Aqueduct work developed a formula and constructed tables that make for rapid, accurate calculations of volumes under such conditions.

For the commonly used grades on the Delaware Aqueduct, the vertical depth of water is practically equal to and coincides with the normal from water surface to the invert. This assumption was made in deriving the volume formula, which is as follows:

$$V = \cot S\left[\frac{x^2 - 2Rx + 3R^2}{3}\sqrt{2Rx - x^2} - R^2\,(R - x)\arccos\frac{R - x}{R}\right].$$

In this formula V is the volume in cubic feet; R the radius in feet; D diameter in feet; m invert grade expressed as a fraction; S angle whose tangent is m; x depth of water at low point in feet. The arc cosine is expressed in radians.

When x is larger than R, the formula applies with second term plus instead of minus. When the tunnel is half full at the low point, $x = R$, and the above formula reduces to $V = \frac{2}{3}\cot SR^3$, while when the tunnel is full at low point, $x = D$, and the formula for volume is changed to $V = \pi \cot SR^2$.

WATER VOLUME IN PARTIALLY FILLED TUNNEL

t	K	t	K
0.1	0.001650	0.6	0.127587
0.2	0.009120	0.7	0.181602
0.3	0.024522	0.8	0.244739
0.4	0.049047	0.9	0.315809
0.5	0.083333	1.0	0.392699

For rapid use of the formulas the accompanying table was prepared. In the table, the depth of water at low point is expressed as a ratio of the diameter or by letting t denote ratio of x to D. The general formula is then modified as follows:

$$V = \frac{D^3}{m}\left[\frac{0.75 - (t - t^2)}{3}\sqrt{t - t^2} - \frac{1 - 2t}{8}\arccos(1 - 2t)\right] = \frac{D^3}{m}K.$$

The value of K is given in the table for values of t ranging from 0.1 to 1.0.

As an example, determine the quantity of water in a tunnel for the following conditions: diameter 15 ft., depth of water at low point 3 ft., tunnel grades 1.9 percent and 1.3 percent. Now $t = \frac{3}{15} = 0.2$; and, from the table, $K = 0.009120$, while $V = 15^3 \times 0.009120 \times \left(\frac{1}{0.019} + \frac{1}{0.013}\right) = 3,987.7$ cu.ft.

For every foot the water rises above the diameter of the tunnel at the low point, the amount of additional water on either side of low point is expressed by $\pi R^2 \cot S = \frac{\pi R^2}{m}$.

In the above example, the quantity of water in the tunnel on both sides of the low point for every foot of height above the diameter is given by $\pi \times 7.5^2 \times \left(\frac{1}{0.019} + \frac{1}{0.013}\right) = 22,897.7$ cu.ft.

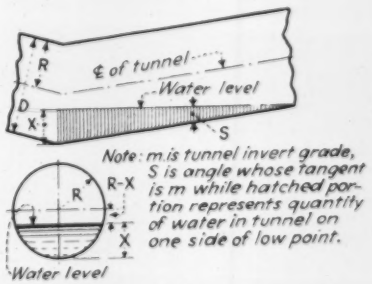

Fig. 1. Formulas for determining volume of water in a partially filled tunnel are based upon notation shown above.

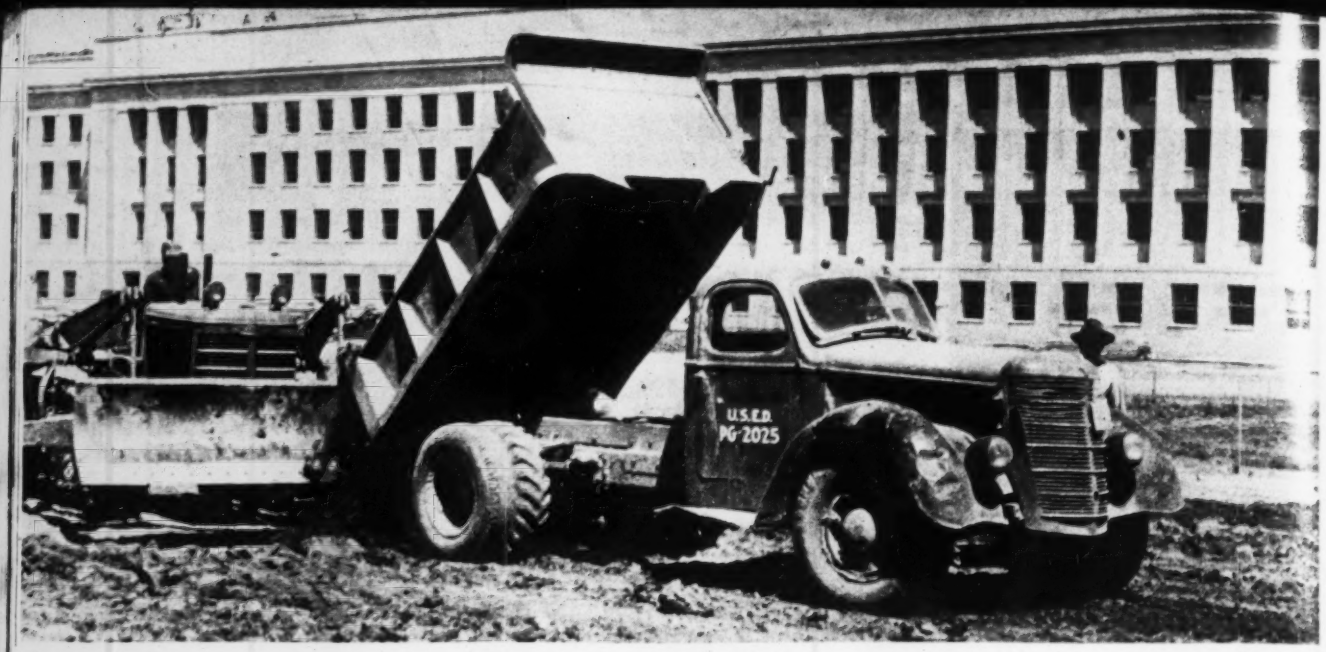

Fig. 1. War Department Office Building in Arlington, Va. forms the background for a 6,000,000-cu.yd. earthmoving job.

Equipment Maintenance on Huge Earth Job

***Contents in Brief**—A number of factors contribute to the constant and smooth operation of 376 pieces of heavy equipment on a 6,000,000-cu. yd. dirt-moving job at the War Department Office Building, Arlington, Va. Better maintenance of the machines is made possible by supplying adequate parts lists, instruction books and complete sets of tools to the repairmen, holding instruction meetings led by manufacturers' service men, and by following a regular schedule of lubrication, inspection and repair for mechanics.*

KEEPING 376 pieces of heavy construction equipment operating, much of it "around the clock," is a major part of the problem of moving 6,000,000 cu.yd. of earth at the site of the War Department Building under construction at Arlington, Va. Regular schedules for routine maintenance and inspection are followed. Daily servicing is planned carefully to keep the units in the field for the full time of their working shifts by having them lubricated and fueled when not assigned to work. A fully equipped repair garage, with complete sets of tools furnished the mechanics, is maintained for tractors and trucks and all repair work, except reboring engines, can be done at the site.

The work is being carried out under a negotiated contract, partly because it was started before plans were completed for the project. About 400,000 cu.yd. of earth were excavated to make way for the world's largest office building (*ENR*, June 4, p. 920), some 4,600,000 sq.ft. of floor space in a structure with only four stories and a basement. The building is a pentagon in shape with each of the five sides 921.65 ft. long and 386 ft. deep to an open central court, also a pentagon, with sides 360.77 ft. long.

Much of the earthmoving is required for roads, sewers, water and utility lines and parking areas to accommodate the 25-35,000 people expected to occupy the structure. A large amount of earthmoving also is necessary for landscaping the grounds and filling the low-lying site to a level that would prevent flooding, as occasionally happened when the site was used as Washington's principal airport.

Some 800,000 cu.yd. of earth will be moved to make a lagoon and contribute to the fill required, but more than 2,000,000 cu.yd. of earth must be "borrowed" for the work. A large portion of this borrow material is being obtained from excavation all around Washington, its only cost being that of supplying additional trucks to compensate other excavators for the longer haul required to the job site. A serious problem is being encountered in getting the trucks through Washington traffic. The problem partially has been solved by trucking only at other than rush hours.

The equipment in use on the project is nearly all government owned. The machines are of almost every make generally used in construction as they have been assembled from all parts of the country. The first thing done when a new make or model of machine comes on the job is to see that parts lists and instruction books are provided. Manufacturers of each piece of equipment are requested to supply complete printed matter in duplicate, one set for the garage and the operator and a set for the office.

Repair and maintenance of the large number of machines require

Equipment used for earth moving

230	Trucks, 4 cu.yd. and up
6	Flat body trucks
60	Tractors and bulldozers
19	Shovels, 1½ cu.yd.
10	Cranes, 10 to 20 ton
2	Backhoes
1	Trenching machine
10	Tractor-drawn bottom-dump wagons, 9 to 13 cu.yd.
8	Carrying scrapers
2	Ten-ton tandem rollers
4	Compressors
16	Double-sheepsfoot rollers
8	Motor-graders

adequate space. Two hangars of the old Washington airport were converted into repair garages, one for tractors and the other for trucks. Small additions have been made for parts and employee locker rooms. Separate buildings serve for storage of oil and volatile liquids, and a wash rack shed is provided.

Repair authorization

When equipment comes to the garage a service manager fills out an "Equipment Repair Order" for jobs estimated to cost under $15 and a supplementary "Equipment Repair Authorization" on more costly work. Each blank has a space in which to describe the machine, the repairs necessary and the estimated cost. On the authorization blank is a space for recording brief details of an accident, if any, and the name and badge number of the operator, insurance coverage and owner of the machine, as well as space for the authorizing signatures. Repairs costing less than $15 are treated as maintenance and require less formal handling

A parts requisition blank, with space for complete identification of the machine, job number, make, model, serial, etc., as well as repair authorization number, and the date the repairs are needed, is made out as soon as the parts required have been determined. A requisition order is issued and the parts are supplied from job warehouse stock if they are available, otherwise the requisition becomes an order to the purchasing agent to obtain the supplies from the best available source. Repair parts most often required are in stock on the job and a perpetual inventory is kept that shows at a glance the exact number of pieces available and what their rate of use has been.

For each piece of equipment on the work a complete use, maintenance and cost card is kept by the Corps of Engineers who are in charge of the project. This card shows the entire history of the machine, the number of hours it has been used, the repairs placed on it and the cost of operation. Also shown is the fuel, oil and grease consumed. This information is obtained from a sheet that has been filled out in the garage showing amounts dispensed to each machine by each shift. Supplementing this record is a large chart kept in the garage office showing lubrication and oil change dates on major equipment on the project.

All available trucks and other equipment work during the day shift, about half are used on the second shift, but only a few work on the third (night) shift. Most of the machines used for hauling require fuel and checking after eight hours, so at the change of shifts those that will continue work are brought to the shop by their operators for quick servicing, while those machines not to be used immediately are left at a distance from the shop. After the rush of getting equipment back to the field for immediate use, a group of regular maintenance men bring up the other equipment, one piece at a time, for servicing. For trucks this means filling with fuel and water and checking the oil, with greasing done on a definite schedule.

Since the rig is ready to go to work when the shift starts, this special crew saves the time of the operators and also loss of working time by the machines. One of the important advantages of having the servicing crew is that only a few people need be acquainted with the details of the work and the keeping of records. This arrangement also eliminates the line-up of equipment waiting for service at the start of the shift when every piece should be working.

Greasing is done with portable high-pressure machines that force lubrication to every part of the bearings. Lubrication charts are made available on each class of equipment,

Fig. 2. Two shifts of repairmen, supplied with adequate tools and instruction, keep the machines running. Old hangars of the Washington Airport are centrally located and have become the repair garages.

Fig. 3. Regular tank-truck services heavy machines that cannot come to the pumps.

and a factory representative of the manufacturer supplying the lubricating machines and lubricants is called in occasionally to give instructions and lead an "open-forum" discussion of problems encountered.

Gasoline is stored in four 2,000-gal. tanks and is dispensed through regular filling-station pumps. Fuel oil is stored in a 1,000-gal. tank. The oil and the oil filter in the trucks are changed simultaneously at the end of each 120-hr. period. The oil and filter on the tractors are changed after about 60 hours of machine operation.

Lubricants for cranes, shovels and for tractors working at some distance from the shop, are hauled to the machines by a truck equipped with all essential material. Greasing is done, generally during lunch periods by the oiler, to prevent the necessity for slowing essential machines. Job-owned tank-trucks haul the gas and fuel oil to this equipment.

Contractor supplies tools

Tools are available in the shop to do every repair operation except reboring of engines and turning of big crankshafts. Occasionally other jobs are sent out to a local repair shop in order to relieve the job shop or because special items can sometimes be more economically done elsewhere. Most of the repair work is on a two-shift basis 7:30 a.m. to 4 p.m. and 4 p.m. to 12:30 at night with a half-hour lunch period.

A full box of hand tools used most frequently is assigned to each man on a shift and he shares their use with another employee, always the same one, on the next shift. There has been no friction between the men on different shifts and practically no loss of tools has been experienced.

A complete set of tools with extra wrenches for special uses is assigned to one man in each crew. This tool box is mounted on castors, as the pieces it contains makes it too heavy for manual handling. A spark-plug cleaner, valve-facer and other speed-up devices are located in the shop for general use. Perishable tools, such as files and electric and special machines, are kept in a nearby room and can be taken out on the employees' time-check "brass" when needed. Making it convenient to get any tool when needed has reduced the cost of equipment maintenance.

It is essential to have the correct types of tools in order to make rapid repairs, but knowing how to use them is even more important. Charts showing important parts of each piece of equipment and instruction books on repairs are readily available to all repair men. The service manager or maintenance instructor from several equipment manufacturers have been brought in to talk to the mechanics in order to explain the best way to handle and service the machines. This type of authoritative instruction has been well received by the men and has proved very beneficial to the job.

Specialists for special jobs

A full-time welder, capable of handling either electric-arc or acetylene process welding, is employed on each shift to make regular repairs. Another man takes care of storage batteries while a blacksmith shop is operated for all job necessities, including rebuilding of shovel dipper-teeth.

Tires are repaired at the site, as many as 45 replacements in one day being made due to nails and other hazards around construction. Constant attention is given to tire maintenance; regular inspection is followed by careful repair of minor damages before they have a chance to become large, recapping is done and tires are discarded only after they are beyond repair. A salvage yard finally receives all the scrap for classification and sale for reuse.

Operation of equipment is quite diversified. All kinds of hauling is done with different types of machines except that all of the borrow material from outside the site is brought in by trucks. The bottom-dump tractor-drawn wagons, loaded by shovel, take the next longest haul while self-loading carrying-scrapers and bulldozers do the short distance moving. In the lagoon area considerable money was saved by temporarily leaving dikes around large areas and removing the dirt by dry-land methods. When the excavation went below the surface of the nearby water, a well-point drainage system was used to keep the area dry behind the natural clay dike.

The War Department Building is being constructed under direction of the Corps of Engineers, U. S. Army, Arlington district, of which Lt. Col. Clarence Renshaw is district engineer. He is assisted on this project by a small staff, including Capt. R. R. Furman, executive officer, who aided in assembling information for this article. Equipment management is directed by Capt. C. H. Smith, operations officer.

Potts & Callahan, Inc., are subcontractors for the earthmoving under John McShain, Inc., Doyle & Russell, and Wise Contracting Co., Inc., the prime contractors. Joseph Werner is master mechanic, A. G. Armstrong is chief engineer and in charge of equipment, and P. F. Davis is manager for Potts & Callahan, Inc.

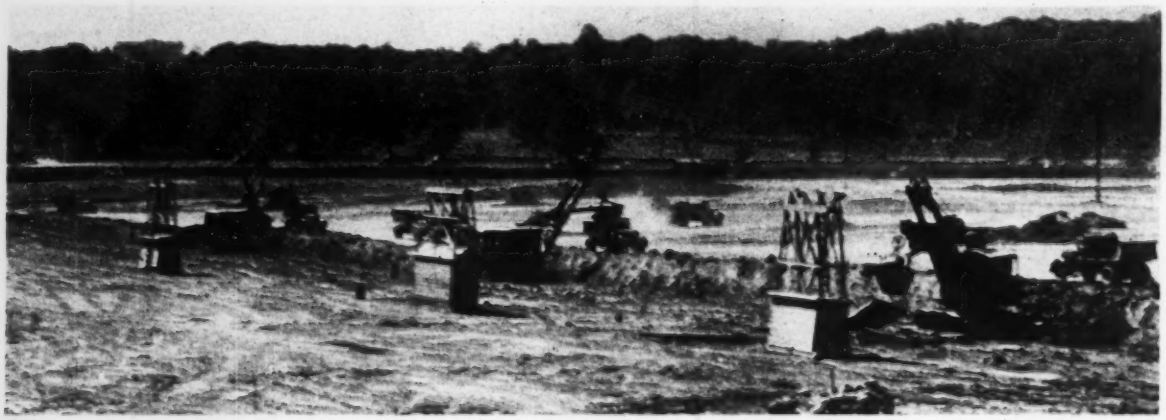

Fig. 4. Shovel-loading and long haul is necessary for much of the dirt moving. Towers on skids carry lights for night.

Tubing Saves Steel in Long Trusses

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Contents in Brief—*For greater savings in steel the use of tubing for the web members of steel trusses is recommended. A design incorporating this substitution is presented for a hangar roof truss of 121½-ft. span. Total weight of the new design is compared with that of the riveted trusses actually built. Also explained are the weight savings made possible by use of the tubing for web members of an all-welded design for the same load requirements. A comparison of the total costs for the various truss designs is given in tabular form.*

In Designing Steel Trusses for buildings a considerable saving in weight can be effected by use of welded tubular steel for web members instead of the usual riveted steel shapes. While the cost per pound of tube steel is relatively greater than that of structural shapes, the total cost—including material, fabrication and erection—of a truss with tubular steel in many cases is much cheaper.

The possibility of effectively reducing the weight of steel trusses by revising the design procedure to include tubular web members—primarily because of the high tensile strength and light weight characteristics of tube steel—was recently suggested by H. L. Whittemore of the National Bureau of Standards (*ENR* Jan. 15, 1942, p. 112). This subject was also referred to in an article by the writer (*ENR* March 12, 1942, p. 418), although a discussion of the subject at that time was necessarily limited to statements of a general nature. It is now possible to amplify these statements by presenting specific details resulting from the redesign of a truss already built.

The structure selected for study is the aircraft hangar roof truss described as a standardized design in the Oct. 23, 1941 issue of *Engineering News-Record*, p. 580. The truss has a clear span of 120 ft., weighs about eight tons, is of the form indicated in Fig. 1, and was shipped to the erection site in four panels. Eleven such trusses were required for a 120x200-ft. hangar.

Gilbert Fish, a New York consulting engineer with wide experience in the fabrication and erection of welded structures, was retained to redesign this truss. He was to use standard round tube sections most favorable to weight saving, and the objective was to prepare a design in which the tube is considered functionally on its merits, not merely as a substitute for structural shapes.

An outline sketch of the proposed truss is shown in Fig. 2 and the dimension of its web members in Table I. The truss is a shop-welded, field-bolted design with tubular web members and chords of rolled shapes. The span and depth make it feasible to ship such a truss in two pieces on most railroads.

In order to reduce the number of web members and save shop labor, the alternate purlins are supported by the top chord acting as a continuous beam. As the bending in the top chord is small, the purlin loads do not increase the weight of the chord much more than the weight-saving due to the omission of struts.

Design of new type truss

In designing the truss of Fig. 2, it was assumed that the trusses are on 20-ft. centers and that the purlin spacing is 7 ft. 7⅛ in. The maximum snow load was taken as 30 lb. per sq.ft., the weight of the wood planking and roof covering as 10 lb. per sq.ft., and the weight of the steel purlins, truss and bracing as 6.4 lb. per sq.ft. Thus, the panel point load is 16.4 x 20 x 7.59 x 7.05 kips.

The axial stresses in the proposed truss members are the same as if the alternate purlins (between panel points) were omitted and the purlins at the panel points each carried a double load or 14.1 kips. A slight correction is needed in the case of the top cord because the purlin loads between panel points cause a local effect on axial compression. This correction amounts to one-half the purlin reaction multiplied by the sine of the slope angle or 0.3 kip, and it is positive in the outer or downhill half of each panel and negative in the other. The top chord bending, due to the purlin load at the midpoint of each panel, is negative at each panel point and positive at the midpoint of each panel. The bending moment in each case is one-eighth of the purlin load times the panel length or 7.05 x 7.59/8 = 6.69 ft.-kips.

Comparisons to AISC standards

All members of the truss shown in Fig. 2 are designed in accordance with the current American Institute of Steel Construction code, which allows a 20,000-psi. stress in tension and bending, a $17{,}000 - .485\ l^2/r^2$ psi. stress in the compression members, and a limit of 120 for the slenderness ratio in the compression members. A limit of 200 is placed on the slenderness ratio for tension members. Exception is the center web members,

TABLE I—WEIGHT AND STRESSES FOR TUBULAR WEB MEMBERS OF PROPOSED TRUSS OF FIG. 2

Member	Compression*	Tension*	Tube Dimensions	Thickness
0–1	....	69.1	4 7/8" O.D.	.238
1–2 (l/r = 64)	62.9	....	5 1/2" O.D.	.259
2–3	....	35.2	4" O.D.	.148
3–4 (l/r = 74)	32.9	....	5 1/8" O.D.	.148
4–5	....	11.3	2 7/8" O.D.	.065
5–6 (l/r = 100)	10.8	....	4 1/8" O.D.	.072
6–7 (l/r = 118)	7.0	....	3 1/2" O.D.	.063
7–8 (l/r = 163)	....	6.7	2 3/4" O.D.	.049

*Stresses are shown in kips

which possibly may sustain a reversal of stress from tension to compression. Their slenderness ratio is kept inside the 170 limit.

Total weight of the proposed truss, including the detail material for the end connections and the field splice, is 9,400 lb.; weight of the tubing is 1,005 lb. This weight is very low for a roof truss of this span. If angles are used to replace the tubing, without changing the remainder of the design, the angles would weigh 1,875 lb. and they would require welded ties or separators weighing about 100 lb. The tubing is, therefore, only half as heavy as the rolled steel it replaces.

Although steel conservation was the prime objective in redesigning the hangar truss to use tubing, the question of cost is equally important. A first criticism is that steel tubing costing $120 per ton is substituted for shapes costing about $44 per ton. However, the question of cost can only be answered when the total fabricating and erecting costs are known. For the new truss to be economical the tubing for the web members need not cost less than the larger weight of the angles replaced, since there are other factors that will appreciably affect the total cost.

These include: (1) each web member is only one piece to be fabricated and welded to the chords, instead of two pieces as when angles are used; (2) numerous small connecting pieces are eliminated by use of the tubing; (3) the tubing lends itself to easy welding, especially with joint designs of extreme simplicity as shown in Fig. 2; (4) the painting cost with the new truss is lower, since in general the tubular members are easier to paint and they can be considered as having about 50 percent less exposed surface than the corresponding angle members; and (5) the shipping cost will be less.

Comparison of truss types

Lacking experience in the actual construction of the tubular truss on a production basis, it is impossible to make a definite cost comparison with conventional methods of design. However, a perfectly logical assumption is that the first hundred trusses fabricated would cost considerably more than the subsequent hundreds, due to the inevitable delays in becoming familiar with new materials, designs and procedures.

In order to make a still better comparison, the proposed truss design was changed to an all-welded design with angles instead of tubing for web members. Summarized in Table II are costs for the truss built, the all-welded design with angles for the web members, and two designs created by substituting tubing for the web members in the two trusses.

For the comparisons in Table II the cost of the steel tubing was taken as 6c. per pound. A study of the table shows that the use of tubing for the web members of the truss constructed would have saved $167.31 per truss, which is more than twice the cost of the tubing. In other words, if the tube cost were doubled there would still be a net cost saving in materials, in addition to the savings involved in fabrication, shipping, erection and bending.

In comparing the proposed truss (Fig. 2) with a welded truss of the same general design but with angles for web members, the possibility of saving is not nearly so spectacular, due to the fact that welded construction calls for considerably less steel than riveted. However, there is still enough weight saving to pay for nearly three-fourths of the cost of the tubing before the important fabrication savings are taken into account. Thus, the use of tubing does not appear to increase the expense, even though a material costing about three times as much is substituted.

But the most important point, in view of the current steel shortage, is that the tubular web members can make impressive savings in steel tonnage over the most economical truss that can be built entirely of flat rolled

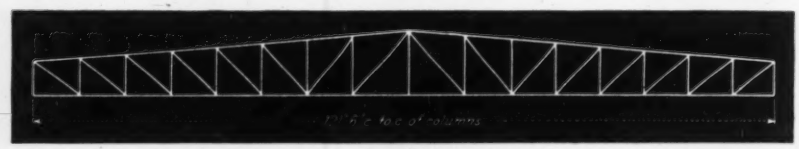

Fig. 1. Roof truss recommended for the hangar-repair shop for the Air Corps. Depth at the ends is 6 ft. and at the center 11 ft. Two 6x6x⅝-in. angles form the upper chord and the lower chord is identical, except the thickness of the angles reduces to 9/16-in. at the ends. For further details see ENR Oct. 23, 1941, p. 581.

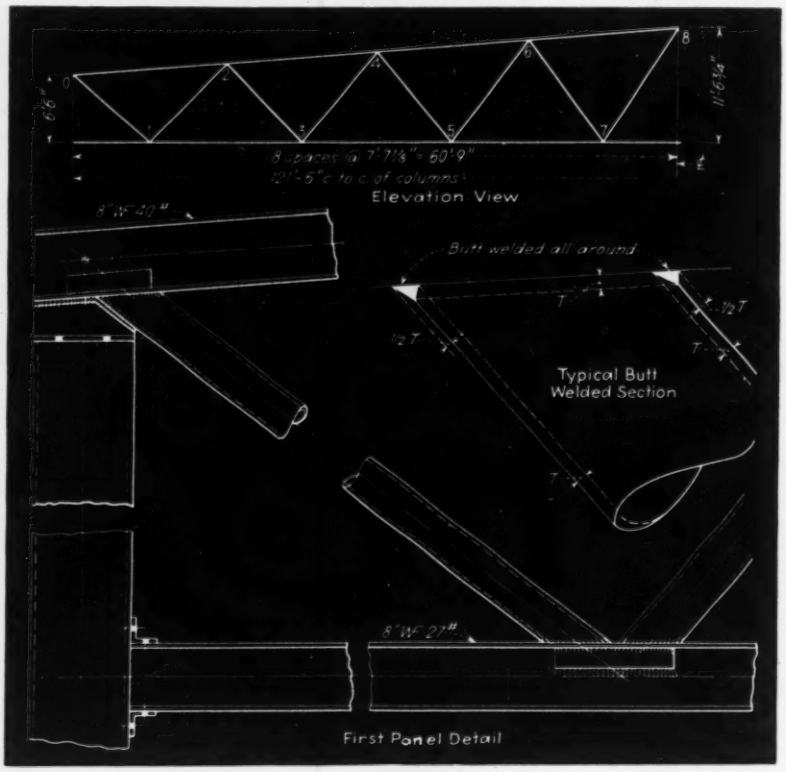

Fig. 2. A truss of all-welded construction designed for the same loads as that of Fig. 1. Steel tubing is used for all web members and the tube thicknesses and sizes are given in Table I. This truss is 5,600 lb. lighter than the design in Fig. 1.

TABLE II—COMPARISON OF MATERIAL COSTS FOR DIFFERENT TRUSS TYPES

Case 1—Standard truss or that actually built (Fig. 1)

Total weight of standard truss	16,000 lb.
Weight of rolled shapes in proposed truss (Fig. 2)	8,395 lb.
Weight of structural shapes saved	7,605 lb.
Cost of structural shapes saved at 2.2c. per lb.	$167.31
Cost of tubing in proposed truss (1,005 lb. at 6c. per lb.)	60.30
Material cost saving	$107.01

Case 2—Welded truss of same design as that of Fig. 2, but with angles instead of tubing for web members

Total weight of truss	10,370 lb.
Weight of rolled shapes in proposed truss (Fig. 2)	8,395 lb.
Weight of structural shapes saved	1,975 lb.
Cost of structural shapes saved at 2.2c. per lb.	$43.45
Cost of tubing in proposed truss	60.30
Material cost for proposed truss is more by	$16.85

TABLE III—STEEL SAVINGS BY SUBSTITUTING TUBING FOR WEB MEMBERS

Case 1—Standard truss of riveted construction (Fig. 1)

	Steel saved, Tons
One truss	3.3
One 80 x 120-ft. hangar	16.5
100 80 x 120 ft. hangars	1,650
One 200 x 120 ft. hangar	36.3
100 200 x 120 ft. hangars	3,630

Case 2—All-welded truss of same general design as proposed truss (Fig. 2) but using angles for web members

	Steel saved, Tons
One truss	0.485
One 80 x 120 ft. hangar	2.425
100 80 x 120 ft. hangars	242.500
One 200 x 120 ft. hangar	5.335
100 200 x 120 ft. hangars	533.500

sections. To stress this fact Table III also was prepared to show the saving for two lengths of hangars, namely 80 ft. and 200 ft. The steel saving for one hangar for each type is given as well as that for a hundred hangars. The data on the steel saving appear more important than the dollar saving that might be accomplished. This is especially so in view of the fact that the men who fly our war planes would prefer to have the extra steel used in the construction of tanks, anti-aircraft guns, or other war equipment rather than as useless dead weight in the roof trusses of their hangars. Admittedly numerous contractors still favor riveted construction and are not well enough advanced in welding experience to build the proposed truss as economically as suggested. But in contrast many firms have adopted welded construction and are in a position to do the fabricating.

Conclusions

In summary certain points should be noted as to the quality of a truss having tubular web members: (1) although the tubular struts designed for light loads have wall thickness less than the leg thickness of the thinnest structural angles, the tube's inside is completely sealed and thus the wall thickness from the corrosion standpoint, may be considered double that of equal thicknesses as angle legs, beam webs or flanges; (2) the curvature of the walls of the tubing is extremely effective in providing protection against buckling, and in the proposed design the ratio of wall thickness to inside radius is in no case less than 0.036; (3) the tubing is smooth and easy to paint and does not catch much dirt, while its shape deters corrosion; and (4) the strictly concentric application of loads to the tubular members and the completely rigid end connections justify a claim that such members are stronger than angle struts designed according to the same rules. It would then seem reasonable to increase somewhat the basic unit stresses and also decrease the penalty for slenderness ratio.

Of course the proposed design (Fig. 2) is only one of many which might be developed and in which greater weight savings might be accomplished by using tubular members throughout. Also, greater economies might be realized through sacrificing a portion of the weight saving by reducing the number of different tube sizes. Such action would reduce the material cost, and the sizes which showed the most favorable cost could be selected. A further advantage might be gained by increasing the allowable unit stress, which could be justified on the basis that the truss as designed is free from eccentric stresses and provides for absolute fixation of the ends of the web members.

Torch Derusts Penstock for Painting

Oxyacetylene flame-priming recently solved a number of problems connected with the preparation of the interior of a badly corroded penstock for protective painting. When the penstock had been drained, inspection of the walls revealed much rust and scale and the presence of large scabs or cauliflower-like growths resulting from pitting and the building-up of rust deposits. Beneath these scabs were large pits that would have to be cleaned out to sound metal. Of equal importance was the necessity of removing the moisture on the pipe to assure a satisfactory bond and a lasting paint job.

The pipe walls were swept down to remove the thick mud, loose material and dirt. Fresh air was provided by a ventilator installed in an above-ground manhole, which kept a gentle current of air moving through the penstock. Oxygen and acetylene cylinders were moved into location on a portable welding truck. The flame-priming operator employed a regular heavy-duty welding blowpipe with an extension arm and a flame-priming head, which had a number of closely spaced flame ports providing a series of high-velocity, high-temperature flames. This heating head was held close to the surface by a long extension arm, so that its high-velocity flames could exert their "blasting" effect even in the deep pits. Due to its design, the same head could be used with complete success to clean the surface surrounding rivets. Hard-faced skids on either end of the head kept it the correct distance from the work and protected it from abrasive wear. The flame-priming operator was immediately followed by a helper sweeping off the granulated, dehydrated rust. Next, the painter applied the protective coat to the clean, dry surface that was still warm and ideally conditioned to receive the paint. All three men worked within a few feet of each other in one continuous operation.—*Oxyacetylene Tips*, March 1942.

Federal Specifications for Vitrified Clay Sewer Pipe Revised

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COMPLETELY REVISED federal purchase specifications for vitrified-clay sewer pipe, augmented to include standards for a new and widely applicable strength classification of this material, are now available. The specifications, which have had no previous change since 1935, are designated as SS-P-361a of the Federal Standard Stock Catalog, Section IV (Part 5). Copies may be obtained from the Superintendent of Documents, Washington, D. C., at 5c. each.

New pipe classification

"Extra-strength clay sewer pipe," a new classification in federal specifications, is designated for installation in locations subject to abnormal trench loadings. Used successfully for more than five years in highway, airport and sewer work, federal approval follows similar previous action by the American Association of State Highway Officials (Spec. M-65-42) and by the American Railway Engineers Association.

Federal standard specifications for conventional sewer pipe, also known as double-strength pipe, and the same material covered by standard specification C-13 of the American Society for Testing Materials, have been streamlined in the new revision. Dimension tables have been recomputed and rearranged to indicate directly maximum and minimum limits for each dimension. Inconsistencies in allowable joint spaces for various pipe sizes have also been adjusted.

Progressive change recognized

In the newly revised specifications, the term "standard pipe" appears as a new general name for the class of pipe commonly known as double strength. At the beginning of the clay sewer pipe manufacturing industry, almost a century ago, most pipe was made to meet a dimension schedule known as "Manufacturers' Standard." Pipe of this type has been generally called single strength. Later, uniform specifications were adopted by the A.S.T.M. and the federal government, providing for heavier, better and stronger pipe to meet increasingly severe service. Pipe conforming to A.S.T.M. and former federal specifications became known as double strength in contrast with the lighter "Manufacturer's Standard." Now, to meet even more severe service, extra-strength pipe, a still stronger classification of pipe, has been adopted.

Double strength, or A.S.T.M. pipe, now designated "standard" in the revision of the federal specifications, is manufactured to meet a minimum strength of 1,000 lb. per lineal foot of pipe per foot of diameter (1,000-D), when tested by the three-edge method. In the smaller sizes (10 in. and under) strength is considerably in excess of 1,000-D. Extra-strength pipe, up to and including 24-in. diameter, under the new specifications meets minimum strength tests of 2,200-D (more than twice that for double-strength pipe) with corresponding increase of strength in sizes 10 in. and smaller. Strength requirements for pipe larger than 24-in. diameter is slightly less than 2,200-D.

No joint difficulties

This strength increase is brought about by improved manufacturing processes and by increase of wall thicknesses of at least 25 percent greater than that for double-strength pipe. To permit the direct interconnection of extra-strength and double-strength pipe without joint construction, the dimensions of extra-strength pipe are fixed so that spigots and sockets of both standard and extra-strength pipe are the same for corresponding pipe sizes. This results in uniform annular spaces where double-strength and extra-strength pipe are jointed together.

Maintenance of uniformity in spigot and socket diameters by holding the outside diameters of double-strength and extra-strength pipe to the same dimensions for corresponding sizes, permits the manufacture of either class of pipe with the same equipment. However, with the same outside barrel diameter for each pipe size and with thicker walls for extra-strength pipe than for standard pipe, the net interior diameter of extra-strength pipe is somewhat less than for the corresponding size of standard pipe. Actually, the reduction is one twenty-fourth of the diameter. Corresponding differences of carrying capacity for ordinary grades and pipe sizes are less than 10 percent.

Since it is virtually impossible to estimate future flows of either sewage or drainage with accuracies anywhere near 10 percent, and because both sewers and drains when built should be provided with reserve capacities on the order of 100 percent or better, no appreciable harm results from the interchangeable use of nominal or net internal diameter when computing sewer capacity. Where extreme accuracy is necessary in such estimates, regular flow formulas, such as the Chezy with either Kutter's or Fanning's method for determining n, may be applied. Adoption of outside barrel diameter as a basis for fixing other dimensions of extra-strength pipe will result, in such rare cases, in little more computation for the engineer designing sewers. But benefits of much greater value and importance are obtained: (1) in the advantage of uniform jointing between the two pipe classes; and (2) in providing for manufacture of extra-strength pipe in existing plants.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Eccentric Riveted Connections

When developing details for the Hell Gate Arch, the writer devised a procedure which he has since used to considerable advantage in dealing with a group of rivets forming an eccentric connection. Because it has never been described in a technical journal, although 30 years old, the method may still possess the quality of novelty.

Assume a group of rivets as in Fig. 1, with a uniform pitch p in both directions. Using an edge distance $\frac{p}{2}$, construct the enclosing rectangle. Then assume the rivets resist the moment $M = Fa$ due to a force F acting at a distance a from the rivet group's center of gravity or point X. Now let L and D represent, respectively, the diagonal distance between the two extreme corner rivets and that between the opposite corners of the enclosing rectangle.

The torsional unit streeses at one of the outer corners, due to M, will act in a direction perpendicular to D and will be $S = \frac{M\left(\frac{D}{2}\right)}{J}$ where $D = \sqrt{d_1^2 + d_2^2}$ and $J = \frac{d_1 d_2^3}{12} + \frac{d_1^3 d_2}{12} = \frac{d_1 d_2 (d_1^2 + d_2^2)}{12}$. Then,

$$S = \frac{6 M \sqrt{d_1^2 + d_2^2}}{d_1 d_2 (d_1^2 + d_2^2)} = \frac{6 M}{d_1 d_2 D}$$

Now, if R = torsional stress from moment M in an extreme rivet, the unit torsional stress at this rivet will be equal to $S\frac{L}{D}$, and we may write, approximately, $R = S\frac{L}{D} p^2$ or

$$S = \frac{R D}{L p^2}$$

If N = number of rivets in the joint, $d_1 d_2 = N p^2$ and we then have

$$\frac{R D}{L p^2} = \frac{6 M}{N p^2 D} \text{ or } R = \frac{6 M L}{N D^2}.$$

This equation is also useful in the forms $M = \frac{R N D^2}{6 L}$ and $N = \frac{6 M L}{R D^2}$.

If the rivet group is more nearly circular than rectangular in shape, the same formula will apply if L equals the diameter of the circle passing approximately through the outermost rivets and D equals the diameter of a circumscribing circle such that $D = L + p$. Generally a rivet group may be practically contained in an assumed rectangle $l_1 l_2$ with an outer rectangle $d_1 d_2$ such that $d_1 = l_1 + p$ and $d_2 = l_2 + p$.

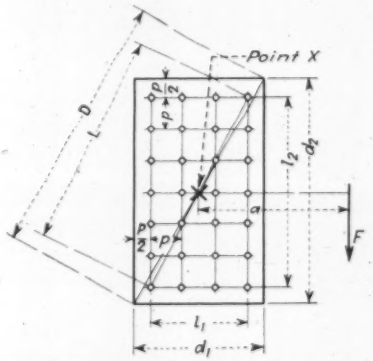


Fig. 1. Assumed joint with uniform rivet pitch p in both directions.

The following example shows the practical convenience of the formula $N = \frac{6 M L}{R D^2}$. Assume that rivets must be placed in a space 30x50 in., as in Fig. 2, and must carry a moment of $M = 5{,}000{,}000$ in.-lb., as shown. Let the maximum allowable stress per rivet be 10,000 lb. and say that the stress due to moment only, exclusive of the direct component, is 9,000 lb. Then $N =$

$$\frac{6 M L}{R D^2} = \frac{6 \times 5{,}000{,}000 \times 51.7}{9{,}000 \times 58.3^2}$$

= 50.7 rivets required.

First assume a 5-in. spacing in each direction. This will produce six rivets horizontally and ten vertically—a total of 60 rivets. As this is more than

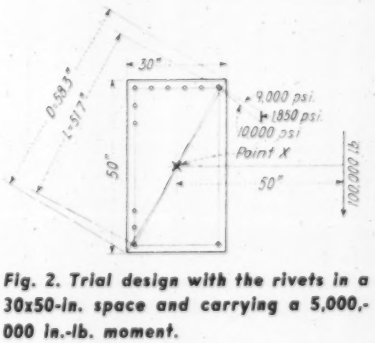


Fig. 2. Trial design with the rivets in a 30x50-in. space and carrying a 5,000,000 in.-lb. moment.

needed, change the vertical spacing to $5\frac{1}{2}$ in. This will produce nine rivets vertically, or a total of 54, which is very nearly the number called for.

By exact computation, the true resisting moment of the joint is found to be 5,122,800 in.-lb., as compared with the assumed moment of 5,000,000 in.-lb., a difference of about 2 percent.

Using 9,000 lb. for the stress from moment in the extreme rivet, and $\frac{100{,}000}{54} = 1{,}850$ lb. for the direct stress, in a vertical direction, the resultant, by the triangle of forces shown in Fig. 2, is 10,000 lb. This is the assumed maximum allowable value per rivet.

The speed with which the formula may be applied makes possible rapid revised estimates as to pitch and the value of R for bending component. In addition, if an exact computation is made from the spacing finally used, the resulting moment will generally be found to be correct within 5 percent.—FRANCIS P. WITMER, *director, civil engineering department, University of Pennsylvania.*

Square Root by Calculator

The theory behind the method of extracting square root with a calculating machine is not understood by many who are familiar with the procedure. Briefly, the method closely follows that used when extracting a root longhand. The number, after being placed in the machine, is divided into periods in the usual manner. The second number of the first period is then placed directly above the keys that are to represent the trial squares. The odd-numbered keys in this row and subsequent rows are used, and the reason for this is best shown by example. Let the number be 712,336, or divided into periods be 71,23,36.

The figure 1 is depressed and subtracted from 71. This causes a figure one to appear in the top right hand window of the machine's carrier. Thus $1^2 = 1$. This figure is not great enough as the greatest square must be subtracted from 71 and still leave a positive number. Then figure 3 is

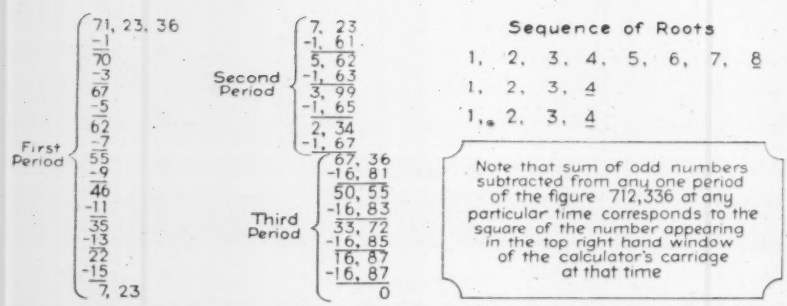


Illustration of how square roots are obtained with a calculating machine. Work is for 712,336.

depressed and subtracted. Thus, a total of 4 has been subtracted from 71, and the figure 2, which is the root of 4, appears in the top right-hand window in place of the figure 1. The subtractions are continued until after 15 is subtracted making the sum of the figures subtracted equal to 64, for, if 17 were also subtracted from 71, a negative number would result.

The carriage is then shifted once to the left and the subtractions continued, but as in the longhand process, the first number of the root must be multiplied by 2. This is automatically taken care of in the machine by changing the last number that was subtracted from 71, from 15 to 16, after shifting the carriage. Thus, the subtractions after the carriage is moved begin with 161.

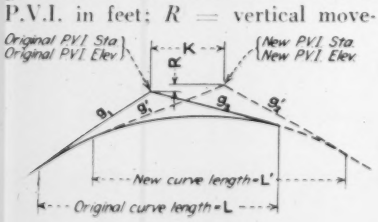
The process can probably be more clearly shown by carrying out the example as it would be solved with the machine. The three rows of figures in the right-hand side of the example indicate the roots as they appear in the right-hand upper window of the carriage after each subtraction. The root of the number in question is composed of the last figures from each row, and in this case it is 844.—SYDNEY L. GOLDBERG, *Galveston, Tex.*

Changing Grades for Vertical Curves Simplified by Formulas

Occasionally the grades of a parabolic curve must be changed without changing the parabola. For example, assume a highway bridge on a vertical curve with steep approach grades. The road on which the bridge exists is now to become modernized. Part of this reconstruction will include reducing the approach grades at the structure. The structure is still serviceable and will be retained. Its pavement must not be disturbed. Therefore the data desired for the new curve are the new P.V.I. station and elevation, and the new curve length.

Three formulas given below and developed by the writer will produce this information directly with a minimum of calculations.

Referring to the curve in the diagram: K = horizontal movement of P.V.I. in feet; R = vertical movement of the P.V.I. in feet; L' = new curve length in feet; g_1 = first original grade in percent; g_2 = second original grade in percent; g'_1 = first new grade in percent; g'_2 = second new grade in percent;



$$K = \frac{L}{2(g_1 - g_2)}\left[(g_1 + g_2) - (g'_1 + g'_2)\right];$$

$$R = \frac{g_1 g_2 - g'_1 g'_2}{g_1 - g_2} \times \frac{L}{200}; \text{ and}$$

$$L' = \frac{g'_1 - g'_2}{g_1 - g_2} \times L.$$

Example: Given, $g_1 = +6$ percent; $g_2 = -3$ percent; $g'_1 = +4$ percent; $g'_2 = -5$ percent; original P.V.I. station = 100 + 00; original P.V.I. elevation = 200.00; and original curve length = 1,000 ft. Now find the new P.V.I. station and elevation and the new curve length.

First determine K, R, and L' as follows:

$$K = \frac{1000}{2(6+3)}\left[(6-3) - (4-5)\right] = 222.22 \text{ ft.}$$

$$R = \frac{-18+20}{6+3} \times \frac{1000}{200} = 1.11 \text{ ft.}$$

$$L' = \frac{4+5}{6+3} \times 1000 = \frac{9}{9} \times 1000 = 1000 \text{ ft.}$$

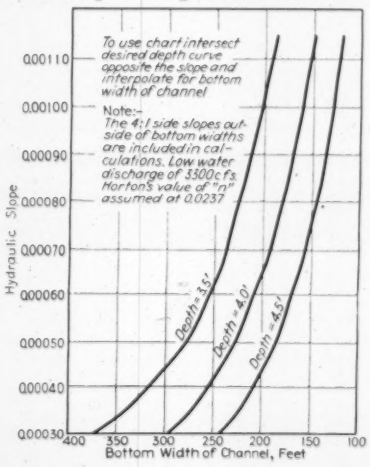
Then Original P.V.I. Station = 100 + 00
K = 2 + 22.22
New P.V.I. Sta. = 102 + 22.22
Orignal P.V.I. Elev. = 200.00
R = 1.11
New P.V. I. Elev. = 201.11

Care should be taken in multiplying and algebraically adding the grades to avoid errors in the signs. Both K and R may have negative values, or one may be positive and the other negative.—EDWARD J. SMITH, *Division of Engineering, New York State Department of Public Works, Albany.*

Channel Dimensions for Constant Flow and Variable Slope

The Willamette River is a gravel-bedded stream subject to seasonal freshets. At Salem, 85 miles above its mouth, the river has a low-water discharge of 3,300 cfs., but during freshets a discharge between 130,000 and 300,000 cfs. will be reached. This variation, plus seasonal dredging, continually changes the low-water elevations and the hydraulic slope on certain reaches. As a result, the calculation of channel widths to maintain project depths is required before all dredging operations can be started.

The accompanying discharge-depth chart was compiled to eliminate much of this work, and the method can be applied to any open channel where the discharge and roughness coefficient are known. The curves were plotted by calculating the width required for a given depth with a given discharge on the following slopes: .00120, .00100, .00080, .00060, .00040 and .00030. Thus, no involved mass of calculations were necessary to construct the chart.—ARTHUR L. ROBERTS, *Assistant Engineer, U. S. Engineer Office, Portland, Ore.*



Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Timber Joint Design

DESIGNING TRUSS JOINTS WITH TIMBER CONNECTORS—West Coast Lumberman's Association, 364 Stuart Bldg., Seattle, Wash. Limited free distribution.

What is best described as a "package" of design data relating to truss joints made with timber connectors has been made available by the West Coast Lumberman's Association. It consists essentially of a series of design sheets and folders planned to bring within brief space all of the essential information for designing connector joints. It should prove indispensable to the man who is undertaking timber design for the first time, but the veteran will also find it of value because it contains an entirely new and much-needed specification for spacing timber connectors to provide for their economical and safe arrangement in the joints. This latter feature was developed by Chester L. Hogue, chief of the association's technical service.

The Panama Canal

THE PANAMA CANAL IN PEACE AND WAR—By Norman J. Padelford. 327 pp. The MacMillan Co., New York. $3.

How the Panama Canal operates today in a time of war is but one of the many questions answered in this well-written book, which makes available much up-to-date information. Starting with an explanation of why a waterway in the general location of the canal was so very important, the author briefly describes the many legal aspects involved before the French engineers could begin construction, next explains why the United States took over the work, and then outlines construction of the waterway. Next are described the legal aspects of the canal's operation and the rights and powers of the American government in regard to the canal. The author goes to considerable length to point out the strikingly different aspects in the use of the waterway in peace and in wartime, clearly explaining what methods were followed during the 1914–1918 World War and how similar measures were taken at the outbreak of present hostilities.

About the latter one-third of the book is given over to a detailed description of how the federal forces maintain the canal, and the duties placed upon the different offices. Also given are the methods by which the charges for a ship using the canal are determined. Data are also made available as to the yearly traffic through the canal since the project was completed in 1914.

Engineering Economics

ENGINEERING ECONOMIC ANALYSIS — By Clarence E. Bullinger. 359 pp. McGraw-Hill Book Co., New York and London. $3.00.

One of the most important functions of the engineer is the conservation of capital. This involves not only economical design and construction, but also the determination of whether or not certain projects should be constructed at all. The engineer should see, insofar as he has the authority, that capital will not be wasted on the provision of facilities which cannot pay for themselves.

Professor Bullinger's book is a very clear and sound expression of the principles underlying the determination of the "worthwhileness" of projects and deserves study by civil engineers as well as industrial engineers. It is written primarily as a text book for students and for the younger men in the profession and must be judged in that light. The exposition is elemental, easy to grasp and, in the reviewer's opinion, eminently sound. The development of the subject is carried out in three parts: first, the economic analysis of a project; second, the intangible analysis, and, third, the financial analysis. In the economic analysis, the various elements entering into the cost of a project are discussed, including the "first-cost pattern," i.e., the variation of first cost with capacity; the matter of depreciation; operating costs and operating-cost patterns; and yield on investment. The criteria required to reach a decision as to worthwhileness of a project are summarized. The method of marshalling the arguments for and against a project, or comparing various means of accomplishing the same result, are treated in a chapter entitled "In-favor-of Analysis." The reviewer hopes that when Professor Bullinger rewrites his book he may change this term to "Relative Merits," which expresses the same idea and is easier to say.

The section on intangible analysis cites the elements which are not directly susceptible of measurement but which may be the determining factors in the choice of whether or not a project is to be undertaken. It is important that the attention of students and younger engineers should be directed to this subject so that they may learn the great importance of early acquiring and developing the faculty of judgment—the prime factor in the success of any engineer.

The section on financial analysis deals with balance sheet and profit and loss data, the means of securing funds, the determination of the rate of use or volume of production at which the project will "break even," general sources of funds and financial structure. Many books have been written on this subject alone and Professor Bullinger might have been justified in developing it at greater length. In the reviewer's judgment, the treatment is adequate for the purposes of this text and is thoroughly sound. Possibly reference should be made in this section to the availability of such data as is contained in the standard investment manuals, in the "Chronicle" and in annual reports of corporations. These sources provide for the young engineer abundant material for the study of the financial problems springing from or related to his work in design or construction.

In the last section of the book, "Special Methods and Applications," Professor Bullinger deals with such subjects as the development of the "break-even" chart, the determination of increment costs, the study necessary for the determination of the economy of replacements, and with the general economics of publicly constructed projects.

In the final chapter on "Studies and Reports," he summarizes the studies required on any project, the analysis of the studies and the presentation of the results in a report. This chapter covers generally all the

factors which the engineer must consider in making an economic study. The form of report is a matter which differs with circumstances. Not all executives prefer a short report. Some very busy men want to have the detail presented for their own independent analysis. Therefore, the form of the report depends first on the purpose of the report and, second, on the individual taste of the prospective recipient.

The material included within the scope of Professor Bullinger's book is an essential part of the education of any engineer. The matter is presented in readable style, the development of the problems is complete and requires no reading between the lines, and the treatment is eminently sound. —*Reviewed by* GEORGE W. BURPEE, *consulting engineer, New York.*

Designing for Continuity

MANUAL OF MOMENT DESIGN—By Jack Singleton. 146. pp. American Institute of Steel Construction, 101 Park Ave., New York. $4.

Like its predecessor, *Manual of Structural Design*, this second book by Jack Singleton is planned to be a desk tool and not a library volume. Whereas the first book was devoted to tables, graphs and working data for simple frameworks of concrete or steel, this *Manual of Moment Design* relates entirely to continuous beams and frames. It covers prismatic members only on the theory that most members are of this type and that where haunched beams are required special studies are necessary anyway. Through its charts, tables and explanatory text the manual is planned to remove as much of the drudgery as possible from the design of indeterminate structures.

Civilian Protection

TRAINING MANUAL FOR AUXILIARY FIREMEN By H. Bond, W. F. Heisler and R. J. Douglas. 406 pp. National Fire Protection Association, 60 Batterymarch St., Boston, Mass. $1.50.

A very worth-while addition to the books now available for the guidance and training of the civilian defense forces of our cities is this training manual for auxiliary firemen, now estimated to total around 500,000, who are giving their services to help protect our cities against the effects of air attack. The methods outlined have already been put to practical test in accordance with a pamphlet issued by the association last winter entitled *A Guide for Training Auxiliary Firemen.*

Miscellaneous Notes on Booklets and Reprints

PROTECTION AGAINST BOMB SPLINTERS by the use of concrete masonry walls is the subject of a four-page pamphlet (No. CP51) just issued by the Portland Cement Association, 33 West Grand Ave., Chicago. Another pamphlet just issued by the association, No. ST51, relates to concrete floors laid on the ground.

COMMEMORATING a half-century of cement manufacture, the Medusa Portland Cement Co. has issued an illustrated book containing a history of the company, biographical sketches of the individuals who had a significant part in its organization and development, and a summary of the many products the company now makes.

REVISED SPECIFICATIONS for asphalt pavements have been issued by the Asphalt Institute, 801 Second Ave., New York. They cover various types of cold-laid asphaltic surfacing, modified penetration emulsified surface courses, cold-mix surface courses, surface treatments, asphalt macadam and asphaltic concrete, asphaltic concrete base courses, stone-filled sheet asphalt, sheet asphalt binder and surface courses, and patching. Revisions were made to incorporate present U. S. standards of simplified practice relating to gradation of aggregates, recent developments in equipment and the latest recommendations of the institute with respect to correlation between laboratory studies and field operations. Copies may be obtained from the institute without charge.

NEW MATHEMATICAL TABLES prepared by the Works Projects Administration of New York City for the National Bureau of Standards are now available from the bureau headquarters in Washington at the prices indicated below. Table on Natural Logarithms (MT10) Vol. III: Logarithms of decimal numbers from 0.0001 to 5.0000 to 16 places of decimals ($2). Table of Natural Logarithms (MT12) Vol. IV: Logarithms of the decimal numbers from 5.0000 to 10.0000 to 16 places of decimals ($2). Tables of Moment of Inertia and Section Modulii of Ordinary Angles, Channels, and Bulb Angles with Certain Plate Combinations (MT11) ($1.25). The last fourteen pages of the latter book contain schedules of properties of plates, ordinary angles, channels and bulb angles. For copies apply to Information Section, National Bureau of Standards, Washington, D. C.

New Engineering Books

HANDBOOK OF SHIP CALCULATIONS, CONSTRUCTION AND OPERATION—Third edition. By Charles H. Hughes. 558 pp. McGraw-Hill Book Co., New York and London. $5.

TRAINING MANUAL FOR AUXILIARY FIREMEN—By Horatio Bond, W. Fred Heisler and R. J. Douglas. 406 pp. National Fire Protection Association, 60 Batterymarch St., Boston, Mass. $1.50.

THE CHICKAMAUGA PROJECT — Technical Report No. 6. 429 pp. Tennessee Valley Authority, Treasurer's Office, Knoxville, Tenn. $1.

PLANE TRIGONOMETRY MADE PLAIN—By Albert B. Carson. American Technical Society, Chicago, Ill. $2.75.

PHYSICS OF THE EARTH—IX: HYDROLOGY—Edited by Oscar E. Meinzer. 712 pp. McGraw-Hill Book Co., New York and London. $7.50.

ACCURATE HOME ESTIMATING—By Thomas A. Roberts and Ruth A. Roberts. 279 pp. The Bruce Publishing Co., Milwaukee. $3.

AMERICAN STANDARD DEFINITIONS OF ELECTRICAL TERMS—254 pp. American Institute of Electrical Engineers, New York. $1.

ANALYSIS OF RIGID FRAMES—By A. Amirikian, Principal Engineer, Bureau of Yards and Docks, U. S. Navy. 396 pp. Superintendent of Documents, Washington, D. C. $1.

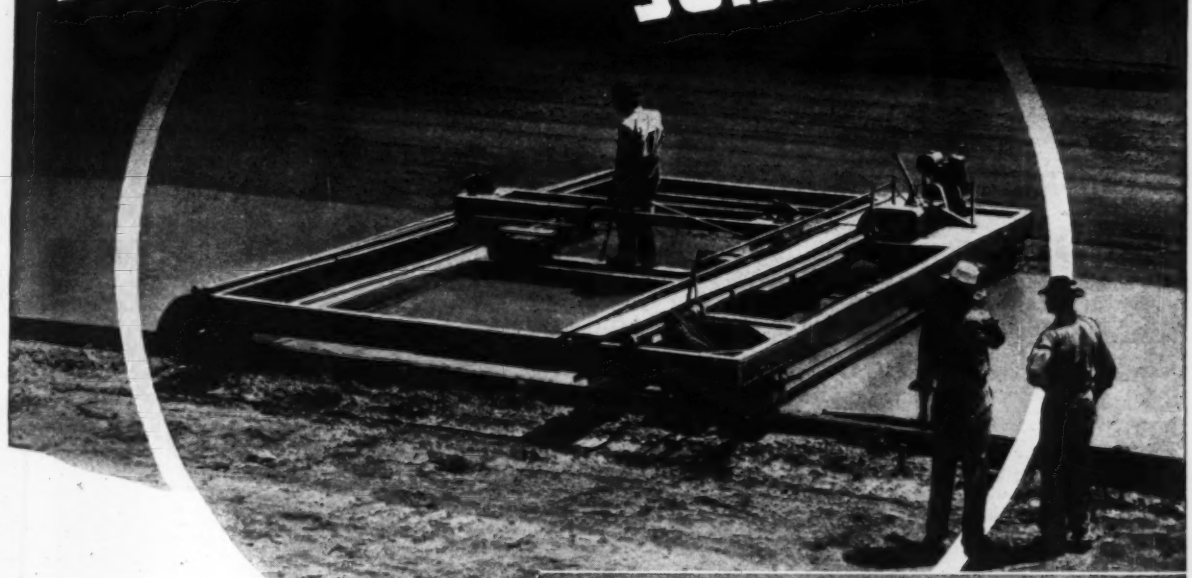
YOUR CAREER IN ENGINEERING—By Norman V. Carlisle. 253 pp. E. P. Dutton & Co., Inc., New York. $2.50.

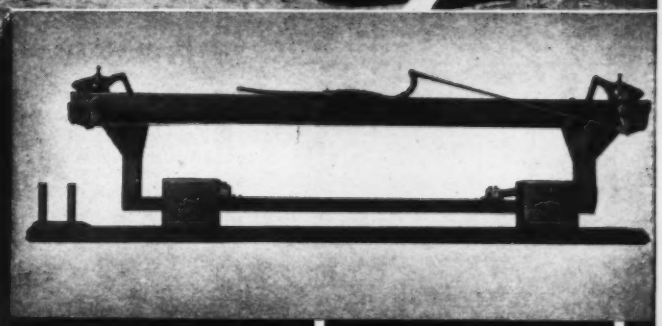
PLASTICS—By J. H. Dubois. 295 pp. American Technical Society, Publishers, Chicago, Ill. $3.

INDUSTRIAL CAMOUFLAGE MANUAL — Pratt Institute, Brooklyn. Reinhold Publishing Co., New York. $4.

PRACTICAL PRINCIPLES OF NAVAL ARCHITECTURE—By S. S. Rabl. Second Edition. 218 pp. Cornell Maritime Press, New York. $2.

ACCURATE SLAB FINISH CORRECTS SURFACE ERRORS.





MECHANICAL FINISHING IS ACCURATE . . .

The Koehring Longitudinal Finisher finishes the slab surface in exact accordance with the crown specifications. Surface errors . . . excess or shortage of concrete affecting thickness of slab . . . are immediately detected because the Finisher screed accurately follows the crown of the slab. High spots are sheared and low spots filled. Correction of surface can be made with saving of concrete. Mechanical finishing with the Longitudinal Finisher is possible after initial set has occurred. Correct timing assures a smooth, accurate finish.

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Carriage and screed travel along specified crown as controlled by carriage wheels on the template tracks. True contour of the slab is assured by this mechanical method. Slab thickness errors are quickly detected.

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HEAVY-DUTY CONSTRUCTION EQUIPMENT

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

GRADE CROSSING ELIMINATION, OHIO

OWNER: State of Ohio, Department of Highways, Columbus, Ohio.

PROJECT: Construction of concrete rigid frame and continuous concrete beam highway overhead structures in connection with grade crossing elimination project in Summit County (Sections Akron, and B), Ohio. Approximately 1.791 miles long, including necessary concrete pavement. Also involves necessary grading, drainage, roadside improvement, and appurtenant structures on State Highways No. 543 and 526. Structure to ease traffic congestion, and provide easier access to defense plant in area.

CONDITIONS: Contractor to furnish all materials and complete work by December 31, 1942. Rail and highway transportation facilities available. Project has been assigned A-1-e priority rating. Wage rates are: skilled labor, $1.15 to $1.75 per hr.; semi-skilled, 75c. to $1.37½; and common, 50 to 82½c. per hr. Engineer's estimate, $678,800.

LIST OF BIDDERS: Bids opened April 28, 1942.

1. A. J. Baltes, Norwalk, Ohio (contract) $675,899
2. Clemmer Constr. Co., and Thorpe Constr. Co., Akron Ohio 678,210

Item	Quan.	Unit Prices (1)	(2)	(3)*
1. Roadway excavation, unclass.	202,008 c. y.	$0.60	$0.50	$0.60
2. Borrow (contractor to furnish)	40,053 c. y.	.45	.50	.65
3. Seal exist. pavement edge	117 l. f.	.04	.10	.02
4. Water	1,075 M gal.	3.00	3.00	3.00
5. 12-in. vitr. sew. pipe; driveways	271 l. f.	1.30	1.00	1.40
6. 12-in. vitr. sew. pipe; storm sew. under pavement	2,337 l. f.	1.75	2.00	2.20
7. 15-in. as above	209 l. f.	2.30	2.00	2.10
8. 21-in. as above	54 l. f.	3.20	4.00	4.00
9. 18-in. as above	76 l. f.	3.00	2.50	3.10
10. 12-in. vitr. sew. pipe; rdwy. drainage	3,173 l. f.	1.50	2.50	3.00
11. 15-in. as above	597 l. f.	1.75	3.50	3.50
12. 18-in. as above	1,068 l. f	2.25	2.50	3.30
13. 21-in. as above	206 l. f.	3.00	3.25	2.60
14. 12-in. vitr. sew. pipe with sealed joints; roadway drainage outlets	668 l. f.	1.50	2.00	4.00
15. 15-in. as above	44 l. f.	1.75	2.25	4.20
16. 18-in. as above	24 l. f.	2.00	3.00	4.00
17. 12-in. vitr. sew. pipe; roadway drainage porous backfill, full depth	2,052 l. f.	1.75	3.25	4.00
18. 15-in. as above	222 l. f.	2.00	2.75	4.00
19. 8-in. as above	234 l. f.	1.50	2.00	1.30
20. 18-in. as above	200 l. f.	3.00	4.50	3.60
21. 6-in. vitr. clay cradle invert pipe; underdrains	4,542 l. f.	1.30	1.60	1.80
22. 4-in. ext. qual. drain tile; underdrains	12,880 l. f.	.40	.30	.44
23. 12-in. pipe spec.; storm sewer under pavmt.	2 ea.	5.00	2.00	8.00
24. 12-in. pipe specials; roadway drainage	1 ea.	5.00	2.00	8.00
25. 12-in. pipe spec. for rdwy. drainage with porous backfill, full depth	2 ea.	5.00	2.00	9.00
26. 6-in. pipe spec. for underdrains porous backfill, full depth	12 ea.	4.00	1.00	5.00
27. 12-in. pipe spec. for outlet pipe	6 ea.	5.00	2.00	7.00
28. 18-in. pipe spec.; storm sewer under pavmt.	1 ea.	15.00	3.00	10.00
29. Standard No. 1 manholes	2 ea.	200.00	100.00	150.00
30. Std. No. 1 manhole frames and covers	2 ea.	30.00	25.00	140.00
31. Std. No. 1-2A catch basins	20 ea.	75.00	60.00	90.00
32. Std. No. 1-3 catch basins	28 ea.	100.00	85.00	100.00
33. Std. No. 2-2A catch basins	4 ea.	75.00	65.00	70.00
34. Std. No. 2-5 catch basins	1 ea.	300.00	100.00	200.00
35. Std. No. 3 catch basins	93 ea.	200.00	105.00	160.00
36. Std. No. 7 catch basins	4 ea.	50.00	35.00	70.00
37. Std. No. 3 comb. inlet manholes	2 ea.	400.00	150.00	280.00
38. Std. No. 6 catch basins	1 ea.	100.00	75.00	80.00
39. Type B riprap	11 s. y.	6.00	3.00	3.00
40. Grouted type A riprap	179 s. y.	10.00	3.50	3.50
41. Concrete steps; 6-in. riser, 12-in. tread	117 l. f.	1.75	2.00	1.25
42. Aggregate for traf. bound side appr	407 c. y.	3.50	3.00	3.00
43. Classified embankment mat'l.	284 c. y.	1.35	1.00	1.50
44. Remove, dispose exist. curb	412 l. f.	.15	.20	.12
45. Remove, dispose exist. bitum. wear course	2,550 s. y.	.20	.30	.15
46. Remove, dispose of brick wear. course	209 s. y.	.35	.30	.30
47. Remove, dispose of existing pavement	17,398 s. y.	.40	.40	.40
48. Remove, dispose of existing header	140 l. f.	.15	.20	.15
49. Remove and store pipe, 15-in. and under	647 l. f.	.50	.50	.35
50. Remove, store pipe, 15-in. and over	95 l. f.	.75	.75	.45
51. Remove and dispose of pipe	11 l. f.	.30	1.00	.30
52. 3-in. fiber conduit	242 l. f.	1.50	1.00	1.00
53. Traf. compacted surf. crse. for traffic lanes	350 c. y.	3.00	3.00	2.40
54. Calcium chloride for traffic lanes	7 ton	40.00	40.00	40.00
55. Abandoned catch basins	6 ea.	10.00	10.00	10.00
56. 6x8-in. sawed wood guard rail posts	314 ea.	4.50	1.10	3.00
57. 1½-in. insulation course	247 s. y.	.35	.20	.20
58. 8-in. port. cem. conc. base course	349 s. y.	2.50	3.00	2.20
59. Waterbound macadam base crse., coarse aggr.	1,906 ton	3.25	4.00	3.50
60. Waterbound macad. base crse., screenings	699 ton	3.50	4.00	4.20
61. Asphaltic conc. leveling course	650 c. y.	16.00	15.00	10.00
62. Asphaltic conc. surface course, type B	409 c. y.	16.00	16.00	10.50
63. Bituminous prime coat (RT-2)	2,493 gal.	.27	.20	.18
64. 9-in. port. cem. conc. pavmt.	71,962 s. y.	2.60	3.00	2.75
65. Port. cem. conc. median strip	1.5 c. y.	35.00	25.00	11.00
66. 6x20-in. sandstone curb	12,880 l. f.	1.60	1.60	1.45
67. Type 4-A concrete curb	26,692 l. f.	.25	.30	.16
68. Type A conc. median strip	425 l. f.	2.50	4.50	1.30
69. Type B conc. median strip	375 l. f.	2.75	5.00	1.60
70. Type 4 combin. curb and gutter	385 l. f.	1.25	1.50	.90
71. 9-in. rein. conc. appr. slab	343 4 s. y.	6.00	7.00	5.50
72. Excav. for struct., unclassified	546 c. y.	1.75	3.00	1.60
73. Channel excavation	3,073 c. y.	.90	1.50	.70
74. Class C conc.; structures	39.5 c. y.	30.00	30.00	24.00
75. Class E. conc.; structures	32.4 c. y.	30.00	20.00	22.00
76. Reinforcing steel	3,793 lb.	.07	.07	.065
77. Remove portions of exist. structure	7 c. y.	10.00	5.00	3.00
78. Remove 2 exist. structures	L. S.	200.00	175.00	95.00
79. 12-in. rein. conc. pipe; rdwy. culv.	137 l. f.	2.00	3.50	1.80
80. 24-in. rein. conc. pipe; rdwy. culv.	73 l. f.	4.00	5.00	3.30
81. 30-in. rein. conc. pipe; rdwy. culv.	92 l. f.	6.00	6.50	4.40
82. 42-in. rein. conc. pipe; rdwy. culv.	242 l. f.	9.00	8.00	7.50
83. 48-in. rein. conc. pipe; rdwy. culv.	63 l. f.	11.00	9.00	9.50
84. 48-in. ext. str. rein. conc. pipe; rdwy. culv.	222 l. f.	12.00	10.00	10.40
85. 15-in. pipe spec. for roadway culvert	1 ea.	12.00	3.00	8.00
86. 24-in. pipe spec. for roadway culvert	1 ea.	25.00	8.00	18.00
87. 42-in. pipe spec. for roadway culvert	1 ea.	40.00	25.00	30.00
88. Excav. for struct., unclassified	2,700 c. y.	2.50	5.00	5.00
89. Cl. C conc.; superstruct. and walls	1,185 c. y.	40.00	35.00	24.60
90. Class E conc.; footings	170 c. y.	25.00	20.00	17.40
91. Type A waterproofing	550 s. y.	1.75	.30	.80
92. Type B waterproofing	110 s. y.	1.00	2.50	2.40
93. Reinforcing steel	184,340 lb.	.07	.065	.08
94. Wrought iron blast plates	4,400 lb.	.12	.10	.18
95. Folded lead strip	190 l. f.	1.50	1.00	.90
96. ½-in. premolded expan. joint filler	860 s. f.	.20	.30	.60
97. Bridge railing (conc. and timber)	250 l. f.	3.50	2.25	9.00
98. 3-in. fibre conduit	250 l. f.	2.00	1.00	1.20
99. Porous backfill	300 c. y.	3.00	3.00	4.20
100. Riprap	40 s. y.	8.00	3.00	3.90
101. Furn. and incorporate black coloring mat'l. in conc.	24 s. y.	.25	1.00	.35
102. Cofferdams and pumping	L. S.	5,000.00	7,000.00	600.00
103. Struct. excavation, unclassified	1,070 c. y.	1.75	3.00	3.00
104. Class C conc.; superstructures	655 c. y.	40.00	40.00	48.00
105. Class E conc.; walls	457 c. y.	30.00	26.00	31.50
106. Class E conc.; footings	459 c. y.	25.00	20.00	17.00
107. Type B waterproofing	52 s. y.	1.75	2.50	2.40
108. Reinforcing steel	266,560 lb.	.07	.065	.08
109. Structural steel	10,500 lb.	.20	.09	.25
110. Wrought iron blast plates	1,100 lb.	.12	.10	.18
111. 1/16-in. sheet asbestos packing	66 s. f.	.10	1.00	1.00
112. Bridge railing (timber and conc.)	387 9 l. f.	3.50	2.25	9.00
113. First test pile (incl. steel point)	L. S.	300.00	300.00	300.00
114. 14-in. creosoted timber piling	6,500 l. f.	2.50	2.00	1.80
115. Steel pile points	312 ea.	2.00	2.00	2.40
116. 3-in. fibre conduit	392 l. f.	2.00	1.00	1.20
117. Furn. and incorporate black coloring mat'l. in median strip	163 s. y.	.25	1.00	.35
118. Seeding and protecting roadway areas	183,567 s. y.	.0425	.04	.05
119. Sodding (sodded ditches)	7,234 s. y.	.40	.40	.35
120. Commercial fertilizer (10-6-4)	33,104 lb.	.045	.03	.04
121. Premium on industrial insurance	L. S.	10,000.00	7,300.00	7,559.86
122. Maintain traffic, incl. lights, signs, barricades, watchman service	L. S.	5,585.00	8,400.00	2,825.00

* *Engineer's estimate.*

HIGHWAY, GEORGIA

OWNER: Georgia State Highway Commission, Atlanta.

PROJECT: Improvement of 8.422 miles of highway in Chattahoochee County, Ga. Involves all excavation, necessary drainage structures, plain cement concrete paving and curbing, bituminous material, aggregate, and roadside improvement.

CONDITIONS: Contractor to furnish all materials and complete work in 240 working days. Rail and highway transportation facilities available. Minimum wage rates specified are: skilled labor, 60c. per hr.; semi-skilled, 40c.; and common, 30c.

BIDS: Six bids were opened April 17, 1942, ranging from the contract low of $1,001,104 to $1,165,332.

LIST OF BIDDERS:

1. Claussen-Lawrence Constr. Co., Augusta, Ga., W. L. Cobb Constr. Co., Decatur, Ga., and Coffee Constr. Co., Eastman, Ga., (contract) $1,001,104
2. Hugh McMath Constr. Co., Columbus, Ga., and Pittman Constr. Co., Atlanta, Ga. 1,095,174

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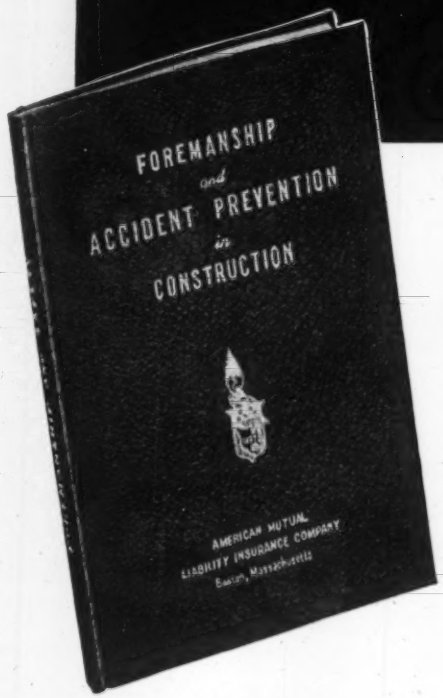

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Chapter I

Foremanship — the foreman's responsibility to his job, to the superintendent, to his men, to his fellow foremen, to subcontractors and the general public; qualities which make for successful foremen 7

Chapter II

The Foreman's Place in Accident Prevention — planning for accident prevention; accident investigation; developing the accident prevention program . . . 15

Chapter III

The Foreman and His Men — selection and hiring, placing and training, supervisory methods 23

Chapter IV

Job Planning — in relation to long range planning, layout of the job, receipt of materials, day-to-day plan 33

Chapter V

Physical Protection — excavation, staging and scaffolding, runways and platforms, barricades, overhead protection, clothing 41

Chapter VI

Care, Use and Storage of Equipment — principles of selection, testing and inspection; rigging, hand tools, supports, derricks, scaffolds, safe practice rules, machine operators, trucks, cranes, moving equipment, moving material, air equipment, machine guards, yard storage, tool storage 51

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3. Hardaway Constr. Co., Columbus, Ga. 1,098,515
4. William F. Rowe, Jr., Augusta, Ga. 1,110,764
5. M. J. Carroll Constr. Co., Leesburg, Fla. 1,113,326
6. H. E. Wolfe Constr. Co., St. Augustine, Fla. 1,165,332

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing and grubbing (240.3 acres)	L. S.	$15,000.00	$18,000.00	$36,000.00
2. Common and borrow excav. (incl. shoulder constr. and reducing back slopes)	1,239,179 c. y.	.22	.24	.24
3. Ditch excavation	10,252 c. y.	.25	.50	.15
4. Channel excavation	2,625 c. y.	.60	.75	.35
5. Structure excavation	6,595 c. y.	1.00	1.00	.90
6. Hydraulic settlement of fills	12,200 c. y.	.05	.10	.05
7. Overhaul on excavation	185,143 sta. y.	.0035	.005	.005
8. 15-in. pipe sidedrain	60 l. f.	1.25	1.35	1.25
9. 18-in. pipe center drain	1,845 l. f.	1.50	1.65	1.50
10. 24-in. pipe center drain	2,180 l. f.	2.50	2.50	2.50
11. 30-in. pipe center drain	1,163 l. f.	3.00	2.75	3.00
12. 18-in. concrete pipe center drain exten	54 l. f.	3.50	3.75	3.50
13. 30-in. conc. pipe center drain exten	42 l. f.	4.50	4.25	3.75
14. Remove culv. pipe, center or side drains	91 l. f.	1.00	.75	1.00
15. Class B concrete headwalls	113.9 c. y.	25.00	30.00	25.00
16. Class A conc. headwalls removed	3,308.16 c. y.	25.00	27.50	27.50
17. Class B conc. headwalls removed	15.22 c. y.	5.00	10.00	5.00
18. Bar reinforcing steel	391,488 lb.	.05	.005	.06
19. Concrete rt.-of-way markers	181 ea.	2.50	2.00	3.00
20. Selected mat'l subgrade treatment	28,625 c. y.	.30	.55	.35
21. Overhaul on subgrade treatment mat'l	26,379 c. y.	.04	.03	.03
22. Mixing subgrade treatment mat'l	26,834 s. y.	.015	.05	.02
23. Selected mat'l culvert foundation	194 c. y.	3.00	3.00	1.00
24. Remove, relay 6-in. water main	1,370 l. f.	1.00	2.00	1.00
25. Grouted riprap apron	60 s. y.	4.00	3.50	2.00
26. 9-7-9-in. plain cem. conc. paving	257,440 s. y.	1.94	1.96	2.07
27. Concrete raised edge curb	15,293 l. f.	.05	.06	.05
28. Rem. conc. approach slabs	426.66 s. y.	5.00	6.50	4.50
29. 6-in. bitum. bound base, R. R. crossing	53 s. y.	1.00	3.50	2.00
30. Bit. mat'l for bitum. bound base	212 gal.	.17	.25	.25
31. Bituminous prime	4,547 gal.	.18	.20	.25
32. Hot application bitum. mat'l	4,951 gal.	.13	.20	.15
33. Seal application bitum. mat'l	4,951 gal.	.15	.20	.15
34. Coarse aggregate cover mat'l	314.5 ton	4.25	4.50	4.00
35. Fine aggregate cover mat'l	127 ton	4.50	4.50	4.00
36. Conc. drop inlet spillways, type B	74 ea.	30.00	50.00	50.00
37. Conc. drop inlet spillways, type A	15 ea.	60.00	45.00	35.00
38. 9x6-in. conc. header with raised edge	270 l. f.	.60	1.00	.60
39. 10-in. Cl. B conc. slope drain pipe	3,050 l. f.	1.00	1.00	.75
40. 8-in. Cl. B conc. slope drain pipe	300 l. f.	.90	.80	.90
41. Guard rail with type C conc. posts	1,008 l. f.	1.25	1.75	1.50
42. Cl. A conc. guard rail connections	8.16 c. y.	40.00	40.00	35.00
43. Bar rein. steel guard rail conn.	3,008 lb.	.05	.065	.10
44. Finishing and dressing	309,745 s. y.	.02	.03	.02
45. Bermeda sprigging	627,997 s. y.	.017	.02	.02
46. Strip sod back slopes	77,368 s. y.	.10	.20	.20
47. Mulching	77,368 s. y.	.01	.05	.04
48. Commercial fertilizer, 8-4-4	41,480 lb.	.02	.025	.015
49. Topsoil (furn. by contractor)	11,376 c. y.	.50	1.25	.45
50. Sod ditch checks	10,008 s. y.	.45	.45	.40
51. Spreader boards	21,227 l. f.	.50	.70	.50
52. Solid sod flumes	720 s. y.	.04	.03	.03
53. Curved back slopes	56,443 l. f.	.03	.05	.03
54. Ground preparation	373,314 s. y.	.60	.45	.50
55. Clay gravel base	4,131 c. y.	.03	.03	.02
56. Overhaul on clay gravel base	58,662 c. y.	.01	.03	.01

HIGHWAY, NEVADA

OWNER: Nevada Department of Highways, Carson City, Nev.; Robert A. Allen, state highway engineer.

PROJECT: Plant-mix bituminous surfacing 12.48 miles of Route 5, Clark County, Nevada. Extends from 14th St. in Las Vegas to a point approximately 11.6 miles southeast of the city. Roadway width 22-ft.; 7-ft. gravel shoulders. Surfacing thickness: 3-in. oiled gravel, and 1-in. bituminous surfacing.

CONDITIONS: Contractor to furnish all materials and complete work in 175 days. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.25 per hr.; semi-skilled 90c.; and common, 80c.

LIST OF BIDDERS: Bids opened April 11, 1942.

1. Wallace & Wallace, Phoenix, Ariz. (contract) $509,667
2. Dodge Constr. Co., Inc., Fallon, Nev. 555,556

Item	Quan.	Unit Prices (1)	(2)
1. Construction signs	L. S.	$750.00	$979.67
2. Remove fence	460 l. f.	.10	.10
3. Remove concrete	10 c. y.	7.50	10.00
4. Remove culvert pipe	2,155 l. f.	1.25	1.00
5. Remove culvert inlets and outlets	24 ea.	25.00	30.00
6. Move signs (set by engineers)	Force Acc.	450.00	450.00
7. Adjust misc. items (set by engr.)	Force Acc.	200.00	200.00
8. Roadway excavation	132,000 c. y.	.35	.30
9. Drainage excavation	4,827 c. y.	.35	.50
10. V-type ditches	32 sta.	.05	10.00
11. Borrow	37,557 c. y.	.28	.25
12. Slope rounding	741 sta.	5.00	.50
13. Overhaul	379,081 sta. y.	.01	.015
14. Overhaul	51,134 y. mi.	.15	.15
15. Structural excavation	7,211 c. y.	1.25	1.50
16. Backfill	5,363 c. y.	.50	.50
17. Subgrade, type B	454,736 s. y.	.02	.02
18. Roadside clean-up (set by engr.)	Force Acc.	1,000.00	1,000.00
19. Water	7,872 M gal.	1.50	2.00
20. Type 1, gravel base	145,952 ton	.50	.45
21. Type 2, gravel base (1-in. size)	78,445 ton	.50	.65
22. Gravel surface	18,037 ton	.55	.65
23. Liquid asphalt, type MC-1 (prime)	445 ton	24.75	21.50
24. Liquid asphalt, type RC-2 (roadmix and plant-mix seal)	118 ton	22.80	20.00
25. Blotter sand	35 ton	3.00	3.00
26. Roadmix	5,964 s. y.	.28	.10
27. Liquid asphalt, type SC-3 (roadmix)	37 ton	22.60	18.00
28. Liquid asphalt, type SC-6 (plantmix)	1,844 ton	20.00	19.00
29. Class F-2 plantmix bitum. surface	35,548 ton	2.20	2.25
30. Class F-2 plantmix bitum. surf., for dikes	1,351 ton	2.70	2.50
31. Class A concrete	415 c. y.	28.00	35.00
32. Class B concrete	1,504 c. y.	26.00	35.00
33. Timber	124 Mbm.	112.00	160.00
34. Relay culvert pipe	736 l. f.	1.50	1.00
35. Move culvert inlets and outlets	35 ea.	25.00	20.00
36. Class A conc. curb and gutter	593 c. y.	26.00	30.00
37. Bituminous foot-paths	6,763 s. y.	.85	1.00
38. Beam type metal guard rail	180 l. f.	2.50	2.00
39. Culvert markers	200 ea.	3.00	4.00
40. Guide posts	20 ea.	4.00	4.00
41. Reconstruct fence	460 l. f.	.15	.10
42. Monuments	83 ea.	5.00	5.00
43. 6-in. plain concrete pipe	8 l. f.	1.50	1.75
44. 8-in. plain concrete pipe	435 l. f.	1.25	2.00
45. 12-in. plain concrete pipe	78 l. f.	2.30	3.00
46. 15-in. plain concrete pipe	95 l. f.	3.00	4.00
47. 18-in. plain concrete pipe	3,454 l. f.	3.60	5.00
48. 24-in. plain concrete pipe	2,097 l. f.	4.85	7.00
49. 30-in. plain concrete pipe	1,380 l. f.	7.20	9.00
50. 36-in. plain concrete pipe	1,692 l. f.	9.20	12.00
51. Concrete neutral bars (2-ft. 4-in.)	427 ea.	1.50	1.50
52. Concrete neutral bars (5-ft. 2-in.)	458 ea.	3.00	2.50

HIGHWAY AND BRIDGE MISSOURI

OWNER: Missouri State Highway Commission, Jefferson City; C. W. Brown, chief engineer.

PROJECT: Improvement of 3.269 miles of U.S. Route 71, near Neosho, Newton County, Mo. Includes grading, culverts, portland cement concrete (non-reinforced) pavement, and reinforced concrete bridge. Pavement width 22-ft.; thickness 8½-in. uniform.

CONDITIONS: Contractor to furnish all materials and complete work in 160 working days. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.00 to $1.35 per hr.; semi-skilled, 57½ to 90c.; and common, 55c.

LIST OF BIDDERS: Opening April 24, 1942.

1. J. M. Roark, Anderson, Mo., and Poole Constr. Co., Kansas City, Mo. (contract) $331,071
2. Atkinson-Windle Co., Chillicothe, Mo., and Fred Weber, Jr., St. Louis, Mo. 351,438
3. Harrison Engr. & Constr. Corp., Kansas City, Mo. 375,257

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing	46.2 ac.	$120.00	$75.00	$100.00
2. Grubbing	46.2 ac.	30.00	75.00	100.00
3. Class A excavation	170,714 c. y.	.44	.415	.38
4. Class C excavation	45,285 c. y.	.44	1.00	1.30
5. Class 3 excav.: structures	2,819.5 c. y.	2.25	2.50	2.50
6. Compacting embankment (rolling)	161,428 c. y.	.04	.03	.05
7. Compacting in cuts (rolling)	15,725 c. y.	.20	.20	.20
8. Removing pavement	1,604 s. y.	.25	.60	.40
9. Removing sidewalk	22 s. y.	.50	.50	.40
10. Water (compacting, rolling)	31,888 hund. gal.	.02	.05	Free
11. Chat or cr. stone surface	546 c. y.	2.00	3.00	2.50
12. Portland cement conc. pavement	61,074.1 s. y.	2.60	2.53	2.60
13. Class B conc. (box culvert)	882.4 c. y.	28.00	27.50	35.00
14. Class B conc. (other than box culv.)	26.0 c. y.	50.00	60.00	50.00
15. 15-in. concrete culvert pipe	904 l. f.	2.00	2.25	2.00
16. 18-in. concrete culvert pipe	297 l. f.	3.00	2.75	3.00
17. 24-in. concrete culvert pipe	208 l. f.	4.00	3.50	4.00
18. Relaid pipe culverts	376 l. f.	1.50	1.50	1.50
19. Reinforcing steel	79,400 lb.	.06	.06	.06
20. Heavy stone revetment	50 s. y.	4.00	5.00	8.00
21. Class C underdrains (tile)	792 l. f.	1.00	2.00	1.00
22. Class C underdrains (French)	100 l. f.	1.00	2.00	1.00
23. Seeding	56.1 ac.	60.00	100.00	100.00
24. Barricades	6 ea.	40.00	50.00	50.00
25. Relocating barricades	6 ea.	30.00	20.00	30.00
26. Cl. 3 excav., for bridge struct	660 c. y.	2.00	2.00	2.00
27. Class B concrete (bridge)	328.5 c. y.	28.00	26.00	35.00
28. Reinforcing steel (bridge)	32,650 lb.	.06	.06	.06

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER PRICES provided the most important change in the construction material list for July. Short leaf Southern pine is $1.00 to $3.00 higher on 2-in. sizes in Baltimore; up 50c. to $4.00 on all sizes in St. Louis; $3.00 higher in Philadelphia; but off $1.00 to $5.00 on all except 1-in. sizes in Kansas City. Douglas fir is $2.00 to $5.00 higher in Baltimore; $7.00 to $18.00 in Philadelphia; but $1.00 to $5.00 lower on most sizes in Kansas City.

Portland cement increased 10c. per barrel in Chicago, the only change in the twenty cities. Ready-mixed concrete rose in Montreal and Los Angeles, but was 15c. per cubic yard lower in Cleveland. Structural steel shapes were unchanged from a month ago, but reinforcing bars were 25c. per 100 lb. higher in Minneapolis, and up 1c. in St. Louis.

St. Louis rates for bricklayers is now $1.75 per hour, compared with the $1.25 to $1.50 range that prevailed last month. Hoisting engineers and plasterers' wages also climbed in St. Louis. Ironworkers' rate is up 5c. per hour in Montreal, and hoisting engineers receive 4c. more per hour in the Canadian city.

Common labor on building, and also on heavy construction, rose to 95c. per hour in St. Louis.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., carload lots, including 40c per bbl. for bags, cash discount not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE Ready Mixed 1:2:4, 50 c.y. or more, delivered
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$8.01
Baltimore	2.36	2.11	1.91	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	7.25
Birmingham	2.50	2.25	....	1.75	1.75	1.50	1.00	1.00	.90	1.15	5.80
Boston	2.75*b*	2.50*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	7.25*m*
Chicago	2.70	2.45	2.30	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	1.50‡	1.50‡	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	6.60
Cleveland	2.39	2.14	....	1.50*i*	1.50*i*	1.30*i*	1.75*i*	1.75*i*	1.75*i*	1.75*i*	7.30*i*
Dallas	2.52	2.27	2.07	1.75*p*	2.00*p*	1.75*p*	1.69*p*	1.84*p*	....	....	6.20
Denver	3.08	2.88	....	1.20	1.40	.90	....	....	....	....	7.25
Detroit	2.40	2.15	1.95	1.50	1.60	1.10	2.25	2.25	2.00‡	2.00‡	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	7.50*n*
Los Angeles	2.80*v*	2.20*v*	....	1.20	1.20	1.15	1.20*f*	1.20*f*	....	....	6.65
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	7.35*j*
Montreal	....	1.90*rs*	1.79*rs*	....	....	1.25‡*t*	.85‡*ct*	1.00‡*ct*	....	....	7.25*ts*
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	9.25
New York	2.60‡	2.35‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	7.25*k*
Philadelphia	2.32	2.07	1.87	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	8.20
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8.25
St. Louis	2.80	2.52	....	1.50‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	8.00
San Francisco	....*u*	2.21	1.81	1.36	1.36	1.36	1.46	1.46	....	....	7.55
Seattle	2.95*o*	2.70*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 25c per. c. y. for cash in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u*. Price withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80	$1.75
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.75	1.70	Universal, Pa.	1.65	1.60
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (Plus 10c. tax in Tex.)	1.75	1.70
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.68	1.67

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT		ASPHALT BINDERS—FLUXES		CUTBACK ASPHALT		ROAD OILS	ASPHALT EMULSION (Quick-breaking)	
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8½ in. carload lots	Wood per sq. yd. 3½ n. 16-lb. treat	Per ton, less than 80 penetration		Per gal., 80-300 penetration		Per ton		Per gal.	Per gal.	
				Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0826*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1348
Baltimore	149.00‡	45.00‡	3.00	15.00	21.00	.06	.09	13.00	23.00	.065	.07	.14
Birmingham	.....	32.00*j*	....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	.....†
Boston	85.00	55.00	3.75	14.00*	20.00*	.06*	.09*	.065*h*	.115*h*	.065*	.09‡*	.12‡*
Chicago	150.00	55.00	2.20*d*	14.80	20.80	13.00*g*	18.50*g*	.0625*h*	.15*h*	.05	.08	.12/.14
Cincinnati	112.00	37.50	....	16.40	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	110.00	38.50	2.25	20.00	25.00	.09	.155	.10*h*	15.00	.07	.11	.15
Dallas	.....	36.00	....	13.25	20.30	.06	.103	16.00	24.80	.055	.05/.07	.07/.09
Denver	.....	27.50	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	37.50	....	15.10*f*	22.60*f*	.0725	.1262	15.10	21.10	.067	.0725	.1262
Kansas City	.....	40.00	....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	....	6.50*b*	15.00	6.50*bg*	15.00*bg*	5.50*b*	.....	.0192	.0525	.1125
Minneapolis	.....	.....	1.87*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	.....	.....	....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	....	13.00*a*	19.00*a*	.055	.085	.06*h*	.09*h*	.....	.078	.....
New York	.....	.....	....	16.40	23.50	.064	.124	.07*h*	.13*h*	.067	.0725	.1225
Philadelphia	130.00	56.50	3.96	14.00	.....	.055	.....	.065*h*	.....	.055	.065	.....
Pittsburgh	135.00	38.75	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	.....	37.00	....	15.00	20.00	14.00*g*	20.00*g*	.06*h*	.11*h*	.045	.09	.125
San Francisco	.....	70.00	....	9.50*m*	18.00*m*	9.50*gm*	18.00*gm*	10.00*m*	17.50*m*	9.50*gm*	.0525*m*	.1125*m*
Seattle	.....	60.00*c*	....	9.50*i*	25.85	.....	25.10*j*	10.00*i*	.....	9.50*i*	.0575*i*	.1308*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. * May prices none later available. † Available on priority only and quoted specially. *m* March prices latest available.

Recently the Government contracted for a Lock Joint pipe line to serve the important base at [redacted]. The purpose of this line was to deliver [redacted] gallons of water daily. Decision narrowed down to a choice between pipe 'A' and pipe 'B,' both of which were Lock Joint pipes. Pipe 'A,' with a greater diameter, was chosen because it was found that by tailor-making the pipe to fit the job it could be built using less of those materials so essential to the war effort. Furthermore, this saving in materials permitted the larger pipe line to be built at virtually no increase in price over the smaller pipe line, and with the assurance of a very considerable saving in operating costs. On any project, the primary purpose of a pipe line is to transport water, and the more efficiently and economically this water is transported, the more apparent becomes the value of the pipe line. It's no secret that Lock Joint pipe is your best investment, today. On your next project—let us help you get the maximum pipe line efficiency at a minimum of expense.

LOCK JOINT Reinforced Concrete **PRESSURE PIPE**

LOCK JOINT PIPE COMPANY
Established 1905
AMPERE • NEW JERSEY
Denver, Colo. • Chicago, Ill.
Kenilworth, N. J. • Kansas City, Mo.
Rock Island, Ill. • White Plains, N. Y.
Valley Park, Mo. • Cleveland, Ohio
Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.75
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.25‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.45*a*	2.50*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates, alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

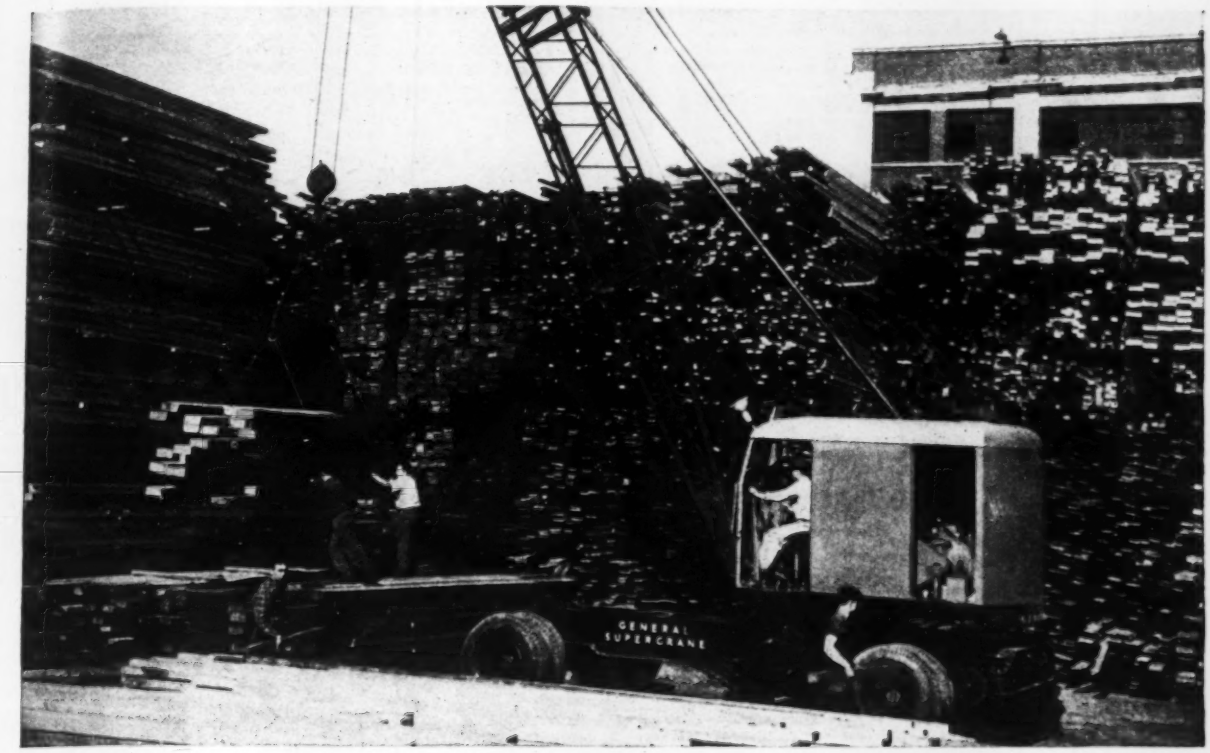
	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 s.f., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	24.00	26.00	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.50	1.80	1.34	.1701	.....
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	.....
Dallas	6.00	3.40	3.40	.....	.....	24.50	26.50	1.93	1.42	.1827	.....
Denver	4.35	3.95	3.80	.....	.....	26.50	28.50	1.97	1.45	.1863	.....
Detroit	3.65‡	2.34	2.24	.....	.10	22.00	24.00	1.68	1.26	.1584	2.66
Kansas City	4.00	2.64*cd*	2.64*cd*	.0	.05	19.60	23.60	1.78	1.33	.1683	2.89
Los Angeles	3.65*f*	3.32	3.32	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.80‡	2.75	2.75	.0	.10	25.00	27.00	1.80	1.34	.1701	2.75*d*
Montreal	3.90*i*	2.55*i*	2.55*i*	.....	.....	26.00*hi*	33.00*hi*	2.56*i*	3.14*i*	.268*i*	.....
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1719	2.875
New York	3.75	2.76*e*	2.76*e*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.65	3.85	....	.....	.....	19.50	21.50	1.71	1.28	.1611	2.74
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.69	2.40	2.40	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.75	2.60	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.50*e*	.....	.....	.....	34.50	38.50	1.93	1.42	.1827	2.95*ej*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	delivered std. 12 in., s.s.	ASTM 24 in.,	C13-35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14-35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.; Lap Weld Black %	Galv. %
Atlanta	$49.40	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
Baltimore	52.80	.36	.60	2.50	7.10	150.00	200.00	.50	1.75	65.5	57.5	63.0	54.5
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.40	1.60	62.2	54.2	59.7	51.2
Boston	55.00	.26	.463	2.07	5.85	140.00	.....	.70	....	64.1	56.1	61.6	53.1
Chicago	55.50	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	62.2	54.2	59.7	51.2
Cincinnati	52.70	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	65.9	57.9	63.4	54.9
Cleveland	54.24	.203	.3915	1.665	5.125	81.00	125.00	.30	1.60	67.8	59.8	65.3	56.8
Dallas	58.20	.305	.549	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	60.60	.24†	.52†	2.16†	....	130.00	240.00	....	....	58.4	50.4	55.7	47.2
Detroit	54.24	.245	.4725	1.935	5.14	82.50	131.25	.35	1.50	66.3	58.3	63.8	55.3
Kansas City	59.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	62.9	54.9	60.0	51.5
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48.6
Minneapolis	59.00	.275†	.495†	1.98†	5.14†	.....	.....	.90	2.10	64.2	56.2	60.7	52.2
Montreal	60.00	.85	1.50	5.25	8.50*e*	135.00‡*l*	260.00‡*l*	.48*m*	1.92*m*	....	....	....	....
New Orleans	51.38	.26	.48	1.69	.....	150.00	220.00	.40	2.10	62.4	54.4	58.8	50.3
New York	52.20	.455	.8775	2.925	7.65	.....	.....	.50	1.20	64.9	56.8	62.4	53.9*i*
Philadelphia	.....	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.4	42.6	53.3	38.9
Pittsburgh	55.60	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5
St. Louis	52.48	.28	.504	2.016	4.50	85.00	220.00	.90*j*	1.60*k*	56.4	42.6	52.5	38.1
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.54	3.30	45.0	31.0	47.0	34.5
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.45*f*	1.40*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 8½c.; ⅜ in., 11½c; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½ in.; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76-37. *k* Reinforced; spec. C 75-37. *l* Plus sales tax. *m* Tax included.



GENERAL

SUPERCRANES are selling faster than we can build them. Still, now is a good time to find out how you can save with a SUPERCRANE.

GENERAL SUPERCRANE!

Why Super? Because it is better!—Because it requires but one operator, and has but one engine—yet is mounted on rubber tires, steers hydraulically, moves without tracks or overhead connections—goes most anywhere. The SUPERCRANE will handle more material faster, easier, and for less cost. Available as Crane, Clamshell, Dragline and Pile Driver.

GENERAL GIVES YOU MORE!

The OSGOOD COMPANY
Sizes [illegible] to 2½ Cu. Yd.
Diesel - Oil Gas - Electric
Associated with
The GENERAL EXCAVATOR CO.

The HERCULES COMPANY
HERCULES IRONEROLLERS
6 to 12 Tons
Diesel or Gasoline
Associated with
The GENERAL EXCAVATOR CO.

GENERAL

OSGOOD MARION OHIO U.S.A. GENERAL HERCULES

Sizes:
⅜-½-⅝-¾ Cu. Yd.
Diesel—Gas—Electric

SHOVELS
DRAGLINES - CRANES
Crawler & Wheel Mounted

THE GENERAL EXCAVATOR COMPANY, Marion, Ohio

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/8"	3/4"
Atlanta	**$29.00**	**$28.00**	**$29.00**	**$27.00**	**$28.00**	**$29.50**	**$40.00**	.....	.....	$60.00	$70.00	$17.90	$21.85
Baltimore	**40.00**	**41.00**	**42.00**	**40.00**	**40.00**	**44.00**	**56.00**	.....	.....	95.00	98.00	18.25	22.25
	45.00	*45.00*	*48.00*	*48.00*	*48.00*	*50.00*	*60.00*	*$88.00*	*$70.00*	.....	.....	.....	.....
Birmingham	**34.50**	**34.50**	**32.00**	**32.00**	**32.00**	**34.00**	**53.00**	**53.00**	**56.00**	.....	.....	17.35	21.15
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....	.....
Boston ‡*	70.00[2]	70.00[2]	60.00[3]	60.00[3]	77.00[1]	100.00[1]	115.00[1]	.....	.....	115.00	130.00	18.25	22.25
‡*	*55.00*	*55.00*	*60.00*	*65.00*	*65.00*	*80.00*	*85.00*	*85.00*	*85.00*	.....	.....	.....	.....
Chicago	**43.00**	**44.00**	**43.00**	**43.00**	**44.00**	**46.00**	**53.00**	.....	.....	90.00	100.00	14.60	17.80
	46.00	*46.00*	*46.00*	*44.00*	*46.00*	*48.00*	*50.00*	*85.00*	*85.00*	.....	.....	.....	.....
Cincinnati	**41.00**	**42.50**	**39.00**	**40.50**	**42.00**	**43.00**	**53.00**	.....	.....	65.00	68.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	.....	.....
Cleveland	**42.50**	**43.50**	**41.50**	**43.50**	**45.00**	**47.00**	**53.00**	57.00	57.00	90.00	93.00	17.75	21.60
Dallas e	**39.50**	**40.50**	**39.50**	**38.00**	**38.50**	**39.50**	**53.00**	**53.00**	**53.00**	78.00	83.00	14.60	17.80
Denver ‡	54.00[4]	52.00[4]	55.00[4]	55.00[4]	55.00[4]	56.00[4]	59.00[4]	*73.00*	*79.00*	.....	.....	10.45	12.70
Detroit	**46.00**	**46.00**	**46.00**	**46.00**	**46.00**	**48.00**	**53.00**	.....	.....	53.00	61.50	17.35	21.15
	.....	.....	.....	.....	.....	*51.50*	*54.00*	*60.00*	*60.00*	.....	.....	.....	.....
Kansas City	**50.00**	**55.00**	**52.00**	**52.00**	**52.00**	**55.00**	**65.00**	.....	.....	75.00	85.00	12.60	15.40
	50.00	*55.00*	*52.00*	*52.00*	*52.00*	*55.00*	*65.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles a	*55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*65.00*	*56.00*	.....	.....	9.90*gh*	12.05*gh*
Minneapolis ‡b	49.00[6]	49.00[6]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
‡	*53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	.....	.....	.....	.....
Montreal †7	*43.00*	*46.00*	*42.00*	*45.00*	*47.00*	*54.00*	.....	.....	.....	200.00	200.00	.....	.....
	42.50	*42.50*	*45.25*	*47.25*	*48.25*	*46.75*	*60.75*	*60.75*	*60.75*	.....	.....	.....	.....
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**34.00**	**35.00**	**48.00**	.....	.....	69.00	69.00	14.60	17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....	.....
New York ‡	**48.00**	**49.00**	**49.00**	**50.00**	**51.00**	**54.00**	**62.00**	.....	.....	120.00*f*	125.00*f*	18.35	22.25
‡	.....	.....	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*75.00*	*75.00*	.....	.....	.....	.....
Philadelphia	**46.00**	**47.00**	**46.00**	**46.00**	**47.00**	**50.00**	**52.00**	.....	.....	80.00	85.00	18.25	22.25
	54.00	*54.00*	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*75.00*	*75.00*	.....	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	18.10	22.05
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis ‡c	**47.50**	**47.50**	**45.00**	**43.00**	**45.00**	**49.00**	**62.50**	*71.00*	*71.00*	79.00	70.00	14.60	17.80
San Francisco d	*35.50*	*35.50*	*38.00*	*38.00*	*37.50*	*37.50*	*43.00*	*43.00*	*43.00*	.....	.....	7.30*g*	8.90*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. * Norway Pine. ‡ Delivered *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

NOTE: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on 5/8", $86.50; on 3/4", $95.30; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
Atlanta	75%	75%	$0.15	
Baltimore	79%	80%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77–10%	77–10%	.15	
Cleveland	77%	77%	.19	
Dallas	78%	78%	.1625	
Denver	76%	76%	.155*e*	
Detroit	79%	79%	.15	
Kansas City	76–10%	76–10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	76%	76%	.155	
Montreal	40–5%‡	47%‡	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	76–10%	76–10%	.155	
San Francisco	78%	80%	.155	
Seattle	75%	76%	.1575†	

Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Plus sales tax.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short — Barge	Leaf — Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.23	$0.26
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.26	.28
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.27	.29
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.28	.29
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.31	.33
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.40	.44
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.45	.482

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.30	....	$1.80	....
	Pine	1.60	$2.40a	2.40	$3.40a
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.20	3.25
Birmingham	White Oak	1.00	1.60a	1.30	2.25a
	Southern Pine	....	....	....	....
Chicago	Red Oak	....	2.40a	....	3.00a
	Southern Pine	....	....	....	....
Los Angeles	Douglas Fir	1.10	1.75a	1.60	2.50a
Philadelphia	Red Oak	....	2.10a	....	3.25a
St. Louis	White Oak	1.65	....	1.90	....
	Red Oak	1.55	2.15a	1.90	2.70a
	Sap Pine or Cypress	1.45	....	1.70	....
San Francisco	Douglas Fir	1.25*bef*	....	....	3.00*caf*
Montreal	Birch or Maple	.85	.95	....†	....†

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6" x 8 x 8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* At ships tackle. † Out of market.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.25– 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.15– 5.50

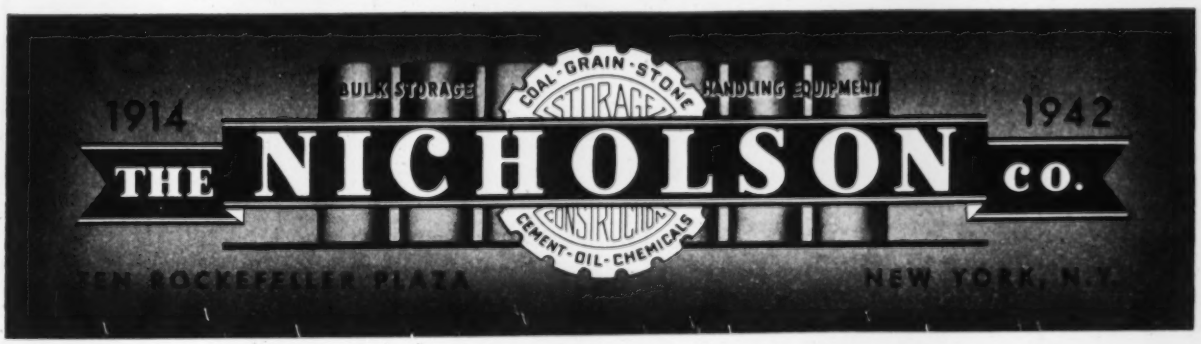
CONCRETE TANKS

REPRESENTATIVE NICHOLSON CLIENTS

Aluminum Co. of America	1	Eastern Coal & Coke	3	National Gypsum Co.	1
American Ice Company, N. Y.	6	Erie Railroad Co., Cleveland	2	Newton, Geo. B., Philadelphia	8
Ballantine Brewery, N. Y.	1	Freeport Sulphur Company	2	New York Central Railroad, N. Y.	3
British Munition Co., Montreal	2	General Aniline Company, Rensselaer	1	N. Y. & Queens Electric Light & Power	1
Burns Brothers, N. Y. C.	10	General Foods Corp., Boston	1	North American Cement Co.	9
Canadian Cotton, Ltd.	1	Genessee Brewing Co.	1	Pennsylvania Railroad Co.	10
Canadian Industrial Alcohol Co.	2	Great Lakes Carbon Corp.	6	Philadelphia Reading Coal Co.	12
Canadian National R.R.	2	Heinz, H. J., Pittsburgh	1	Pittsburgh Corning Corp.	1
Central R.R. Co. of New Jersey	2	Household Fuel Company	7	Pittsburgh Coke & Iron Co.	2
Century Cement Co.	2	International Harvester Co.	2	Plibrico Co., Chicago	1
City of Hamilton, Ontario	2	Jersey Central Power & Light Co.	2	Reading R.R., Philadelphia	12
City of Kansas City, Kansas	2	Jersey Central R.R. Co.	2	Schenley Distillers	1
City of Memphis, Tennessee	1	Lancaster Cotton Co., S. C.	2	Semet Solvay Co.	2
City of New York	1	Leaside Munitions Co.	2	Southern Railroad	7
Colgate Palmolive Peet	1	Lehigh Portland Cement Co.	3	Stone & Webster Corp., Boston	2
Conger Lehigh Coal Co., Toronto	4	Lehigh Valley R.R.	8	Tattersall Company, Trenton	3
Consolidated Edison Co., N. Y.	4	Libbey-Owens-Ford Glass Co.	3	Universal Atlas-Cement Co.	1
Cullen Fuel Co., New York	6	Linde Air Products Co.	2	U. S. Army	3
Dependable Fuel Co., New York	6	Lone Star Cement Corp.	1	U. S. Navy	2
D. L. & W. Coal Co., N. Y.	28	Long Island R.R., N. Y.	2	U. S. Dept of the Interior	1
Dominion Glass Co., Toronto	2	Maine Coal & Dock, Bangor	2	Vermont Asbestos Corp.	2
Dominion Sheet Metal, Ltd.	2	Meenan Coal Company, N. Y.	5	Westinghouse Co., Pittsburgh	1
DuPont Company, Wilmington	2	Milnes Coal Company, Toronto	4		
		Montreal Cottons, Ltd.	1		

(Numbers after each name indicates number of contracts.)

CONCRETE TANKS EXCLUSIVELY SINCE 1914



STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION — SCORED Per M. lots of 2,000 pieces or over,			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over,			BRICK Per M. in quantity.		LIME		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$244.00	$13.54	$18.04	$26.54	$15.04	$15.03
Baltimore	82.00	88.00	165.00	195.00	260.00	320.00	14.00*k*	17.00*k*	18.00	12.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25*m*
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271.80	308.20	18.00*i*	21.00*i*	20.00	14.00	17.00
Chicago	70.15	75.00	141.25	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.40	12.90	...
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	14.50*j*	13.25*j*	3.00*m*
Dallas	52.00	54.00	100.00	135.00	200.00	263.00	11.50*i*	13.50*i*	19.00	15.00	.95*n*
Denver	84.80	94.40	152.70	178.20	212.00	227.90	13.50	17.00	30.00*j*	19.00*j*	30.00
Detroit	78.20	86.40	159.60	203.00	263.50	301.00*c*	17.50	18.00	16.50	13.90	14.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	14.50	15.50	19.32	13.00	10.92
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.00*b*	86.40*b*	146.90*b*	.....	177.00*b*	246.00*b*	13.60	15.60*g*	21.00	16.00	19.00
Montreal	72.20*au*	77.50*au*	142.50*au*	76.00*au*	165.80*au*	248.70*u*	22.00†*u*	27.25†*u*	23.50*u*	17.00*u*	12.00*u*
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	14.50	.....	20.00	14.00	17.00
Philadelphia	90.00	97.70	183.20	197.10	243.20	301.10	17.00	20.00	15.50	8.55	10.55
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.55*m*
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	18.00
San Francisco	84.00	94.50	225.00	.....	.....	.....	17.50	22.00	20.00	20.00	16.40
Seattle	105.00	115.00	210.00	.....	.....	.....	19.50*f*	20.50*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* 50c. per M. off for cash. *j* LCL. *k* $1.00 discount if paid in 10 days *l* Lump. *m* Per bbl., 180 lb. *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *t* 5½x8x12. *u* Plus 8% sales tax.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

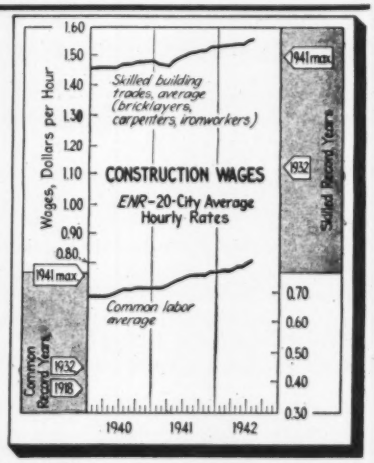
	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl.	WHITE LEAD	READY-MIXED PAINT Per gal., drums			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Dry *a*	Per 100 lb. in oil	Graphite *b*	Aluminum *b*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	30.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	2.70‡	3.65‡	2.50‡	1.90‡	1.90*h*‡	1.90*h*‡	.50‡	20.00‡
Chicago	10.00	13.75	2.11	2.63	1.72	1.75*hf*	1.66*hf*	1.82*hf*	.33*f*	23.00*f*
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	10.00	13.75	2.10	4.80	1.95	1.93	1.83*h*	1.83*h*	.35	29.00
Dallas	10.00	14.50	1.88	2.11*n*	....	2.30*h*	2.25*h*	2.45*h*	.35	39.00
Denver	10.50	14.25	1.65	2.60	.27*l*	2.45	3.15	3.15	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.40	2.50	2.50	.35	22.00
Kansas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*gn*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*hi*	1.66*hi*	.32	23.00
Montreal	9.25	6.25	2.40*p*	2.97*p*	2.51*p*	2.85	2.58	2.07	.63	1.85*k*
New York	10.00	13.75	2.05	2.55	1.64	1.66	1.58*h*	1.58*h*	.26	26.00
Philadelphia	10.00	13.75	....	....	....	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	....	....	....	1.75	1.66	1.66	.34	24.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.10/2.00	1.71	2.40	2.40	.33	19.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	28.50*j*

‡ Delivered Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted specially.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const
Atlanta	$1.375	$1.00	$1.375	$1.00/1.25	$1.25	$0.40	$0.50
Baltimore	1.625	1.375	1.65	1.65	1.50	.70	.70
Birmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.25/1.625	1.25/1.50	1.50/1.65	1.25/1.875	1.25/1.667	.80/1.00	.80/1.00
Chicago	1.70	1.625	1.70	1.70	1.825	1.025	1.025
Cincinnati	1.75	1.50	1.625	1.40/1.55	1.625	.80	.80
Cleveland	1.75	1.50	1.75	1.75	1.75	1.00	1.00
Dallas	1.50	1.00	1.25	1.00	1.50	.50/.625	.50/.625
Denver	1.65*b*	1.43*b*	1.43*b*	1.43*b*	1.51*b*	.718*b*	.718*b*
Detroit	1.60	1.40	1.75	1.625	1.675	.80	.80
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.55
Los Angeles	1.50	1.175	1.50	1.50	1.667	.75	.75
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.375	1.375	.60	.60
New York	2.00*b*	1.85*b**	2.00	2.00*b*	2.00*c*	1.031	.95
Philadelphia	1.90	1.50	1.80	1.65	1.875	.825	.825
Pittsburgh	1.90	1.50	1.75	1.5625/1.625	1.75	.80	.70
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.75*c*	1.375	1.60	1.50	1.667*c*	.875	.875
Seattle	1.715	1.415	1.615	1.565	1.715	1.015	1.10
Montreal	.965	.855	.90	.80	.945	.505	.505

b 7 hr. day. *c* 6 hr. day. *d* 35 hr. wk. *e* 30 hr. wk. *Negotiating now for increased rate.



ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.556
ENR Common Average: $0.803

QUIZ on application of *soil-cement* for light traffic war pavements

When should soil-cement be considered?

Answer: The field of use of soil-cement includes low first-cost auxiliary and secondary airport surfaces, plane parking areas and taxiways, light-traffic military roads and streets, parking areas for army trucks and war workers' cars, road shoulders and widening.

What types of soil can be processed?

Answer: Soils on the site are usually satisfactory. Old gravel or stone roads also can be successfully treated. 50% minus No. 4 sieve material is needed.

What engineering supervision is required?

Answer: Job control by a full engineering field force giving careful attention to details is essential. Simple, scientific procedures in *both* laboratory and field assure uniform results at any job speed.

What rate of construction can be planned?

Answer: Uusually 5,000 to 10,000 sq.yd. daily; 10,000 to 20,000 frequently obtained; 350,000 sq.yd. in 19 working days reported for one job; 26,000 sq.yd. in peak day of 16 hours on another. Rate of production may depend on ability to put competent engineers on the job, rather than on work crews and equipment. Speed is result of efficient organization of simple equipment and small crews of ordinary labor.

What material must be transported?

Answer: Generally just the cement and water. Soil-cement, being approximately 85 to 90% soil, requires little trucking or rail haul of materials. When borrow soils are occasionally used, short truck haul is common.

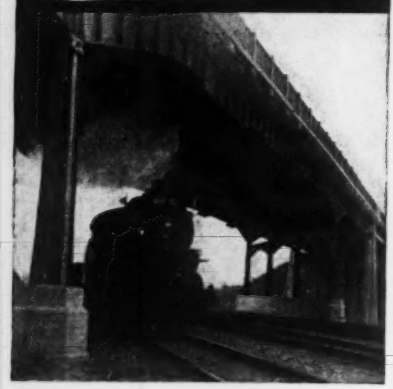
Call on our engineers for design and construction assistance on your soil-cement war projects. Write for "Soil-Cement Construction Details," mailed free in the United States or Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 7A-170, 33 W. Grand Avenue, Chicago, Illinois

BUY WAR SAVINGS BONDS AND STAMPS

NO "ACHILLES' HEEL" ON THIS BRIDGE!



• The strongest bridge has an "Achilles' heel" if locomotives continually blast it with corrosive cinders and firebox gases. Yet on proper priority you can protect such danger spots with ARMCO Asbestos-Bonded Blast Plates.

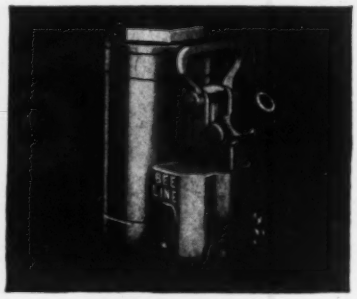
Unskilled men easily make the installation. The cost is low. Durability is assured. A thick special bituminous material is tightly bonded to the substantial ARMCO Ingot Iron base plate by ARMCO's asbestos-bonding process. This coating is chemically inert to corrosion, highly resistant to abrasion, and will not support combustion at temperatures as high as 1100° F.

It is wise *any time* to safeguard new and old bridges this low-cost way. Right now, with bridge materials so precious and so difficult to replace, this protection is vital. Write for complete information. ARMCO DRAINAGE PRODUCTS ASSN., 225 Curtis Street, Middletown, Ohio.

ARMCO
ASBESTOS-BONDED
BLAST PLATES

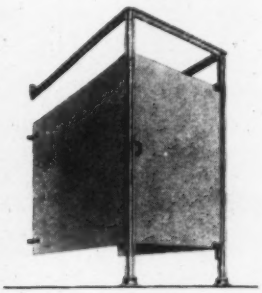
New Aids to the Constructor

Equipment and material announcements and manufacturers' news



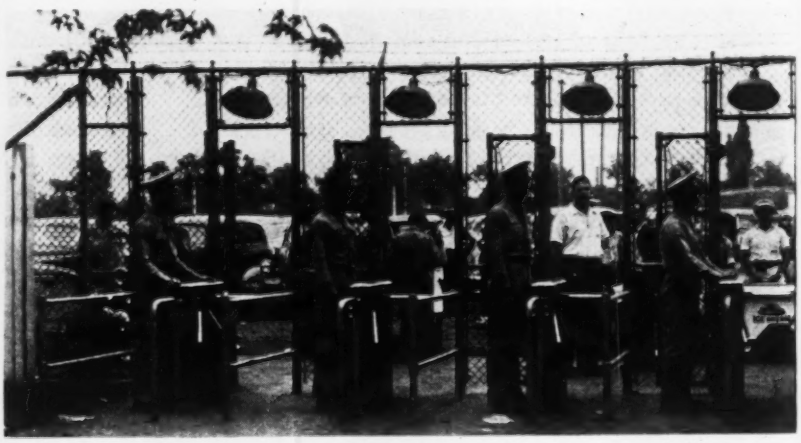
Hydraulic Jack

The Bee Line Company has announced a new 50-ton hydraulic jack to serve innumerable purposes, particularly for work requiring a compact jack of light and sturdy construction. Some of the features said to be included in the new jack are: a new principle of construction recently patented—a step ahead in hydraulic efficiency; large oil ports and passages assuring quick return of ram; simple construction; large pressure areas requiring large oil pressure per ton of lifting capacity; automatic take-up on all packing; 50 percent overload guarantee. Total weight of the jack is 74 lb. —*The Bee Line Company, Davenport, Ia.*



Wood Compartment

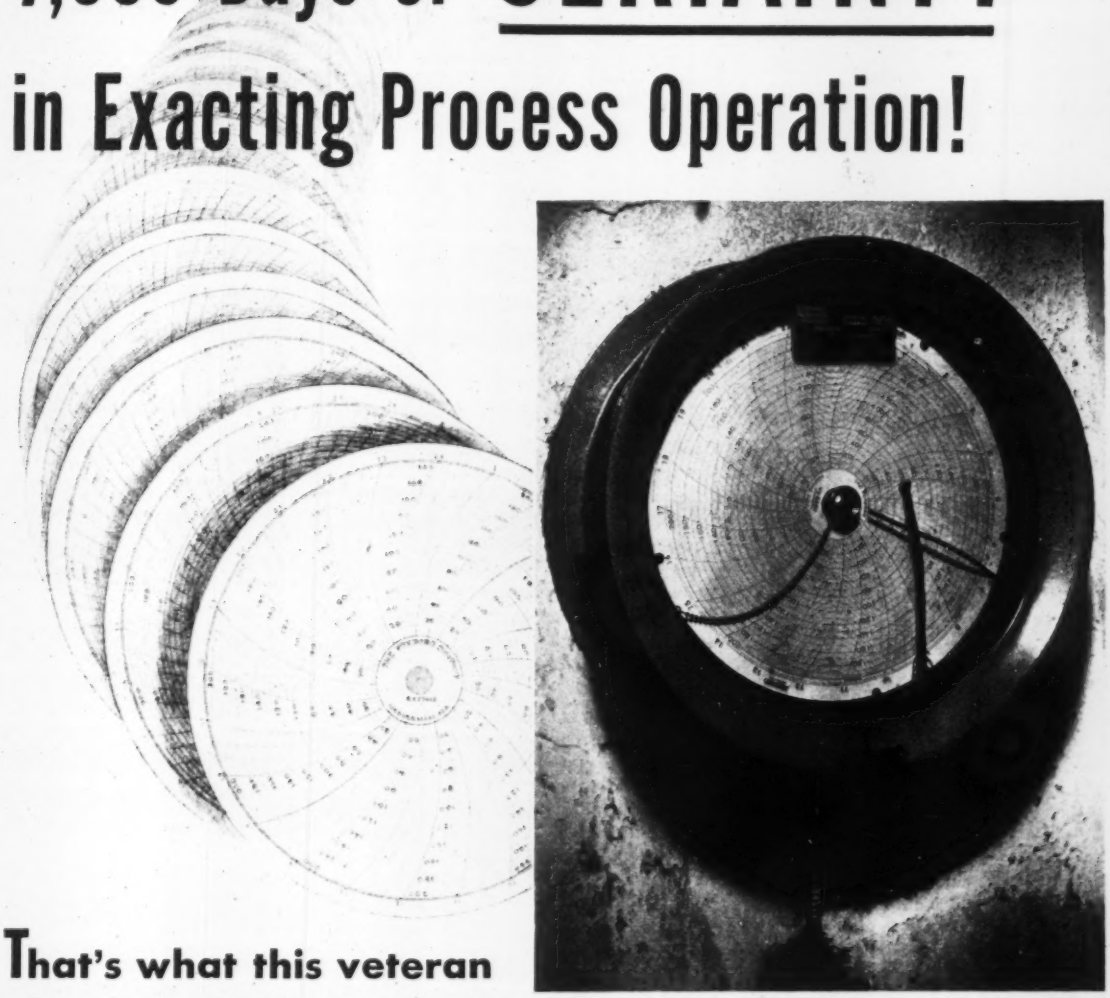
In anticipation of war construction needs and in cooperation with the War Production Board, the Sanymetal Products Co., Inc., has converted its four types of steel toilet compartments to all wood construction, utilizing seven ply Douglas fir plywood for partition panels and doors. Each type, when made of seven ply Douglas fir plywood, is similar in design and construction details to the steel fabricated type. These compartments are known as Sanymetal's "All Wood Wartime Toilet Compartments," and are offered as temporary substitutes for steel compartments.—*The Sanymetal Products Co., Inc., Cleveland, Ohio.*



Turnstiles

A solution for the provision of airtight and foolproof gate guarding at entrances and exits in plants engaged in war production is claimed by the Perey Turnstile Co. The automatic operation of Perey systems gives added protection because the guard can devote all his attention to identification. When guards are reinforced with Perey turnstile systems, they are said to be less subject to fatigue, lowered efficiency and carelessness. The turnstiles are designed for every plant gate purpose. Some are designed as traffic controllers, others register entrance, others operate by means of tokens which classify and register different classes of employees, others can be controlled remotely and still others can automatically permit one way entrance or exit but are impenetrable in the other direction.—*The Perey Mfg. Co., Inc., 101 Park Ave., New York, N. Y.*

7,500 Days of CERTAINTY in Exacting Process Operation!



Every day for 25 years, Cleveland Fruit Juice Company has used this Foxboro Recorder to guide production!

That's what this veteran Foxboro Recorder gave to one manufacturer!

Ask the Cleveland Fruit Juice Company whether they consider it essential to keep *records* of processing conditions. Their own past practice gives the most conclusive answer!

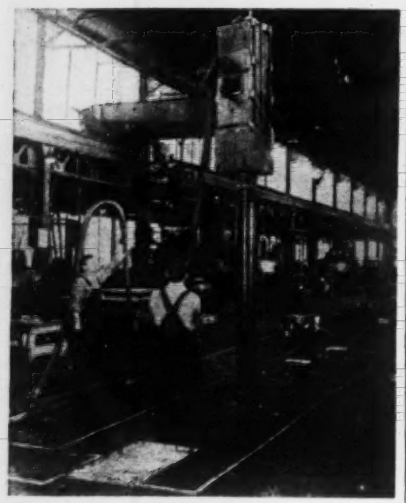
Every working day for 25 years, this company has kept a continuous record of one critical process temperature. Simply through use of the Foxboro Temperature Recorder shown here, costly guesswork has been eliminated. And this veteran instrument is still in perfect calibration . . . still supplying exact production guidance every day!

No matter what part of your operation demands "close" control, its efficiency is bound to benefit from the certainty supplied by Foxboro Recorders. Automatically, you get the exact facts about each run to help you save steam, materials and costly re-runs. Uniformity can be assured.

Write for detailed bulletins on Foxboro Recorders for Temperature, Pressure, Flow or Humidity . . . recorders that give sustained accuracy without servicing. **The Foxboro Company, 142 Neponset Avenue, Foxboro, Massachusetts, U.S.A.** Branches in principal cities of the United States and Canada.

FOXBORO
REG. U. S. PAT. OFF.
Instruments

Inside Information!



How to

Speed Plant Building

or additions . . . USE

UNION HAMMERS

★ Use these famous Hammers with the double-acting drive for fast work! Their simple one-piece frame, absence of bolts in moving parts, and central-point lubrication are just 3 outstanding features that *"keep 'em driving!"* Use steam or compressed air without changing parts, and get a lot done on little power. A complete series to choose from, for ALL types of driving.

★ ★ — *and this other*

UNION EQUIPMENT

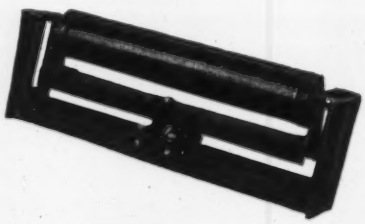
AIR LOCKS BUCKETS	CABLEWAY SKIPS CONCRETE PLACERS
GROUT MIXERS AND EJECTORS	FOUNDATION EXCAVATORS SKIPS
PILE DRIVER HOISTS & LEADS	SPECIAL MACHINERY

Ready! —for quick reference and ALL FACTS on what UNION makes for speedy plant construction—write or wire NOW for Catalog 184.

UNION IRON WORKS, INC.
Engineers and Manufacturers
Spofford & Lidgerwood Aves., Elizabeth, N. J.

Water Meter

The Pittsburgh Equitable Meter Co. has announced the development of the Empire Victory water meter. This meter is designed with a cast iron outer case and a molded glass register box in order to conserve vitally needed brass for the war effort. The manufacturer claims that about 70 percent of the bronze normally used in a domestic size meter has been eliminated, without sacrificing any of the quality construction details. It is said that the cast iron outer casing of the Empire Victory meter is especially treated, coated and lined to prevent the formation of rust. Machined surfaces are chemically treated to inhibit corrosion. Of special interest is the molded glass register box, described as a single piece, strong, molded glass unit which fits snugly over the register and is retained against a fibre gasket by two screws. The meter utilizes the same oscillating piston principle of measurement that has grown so successful. The measuring chamber is of the snap joint type, within which operates a balanced piston having a centrally located web.—*Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.*



Conveyor Belt Idler

The Chain Belt Co. announces a new self-aligning idler for flat conveyor belts, both return and carrying, which will help to keep the belt central on its supporting idlers, important for longest possible life for the belt. The operation of this self-aligning idler is sensitive and instantaneous. If for any reason the conveyor belt runs to one side, it has a tendency to

A POSITIVE GRIP
Why? ..

WHAT DOES IT ADD TO APPEAL?

THE gripping unit in an Electroline-Fiege Wire Rope Connector holds like a Bulldog because it has a "Positive Grip". The holding compression is graduated from front to rear so that danger of crystallization, due to vibrations, is eliminated. Frayed strands and early failures are avoided.

Many other advantages, such as greatly increased wire rope life, elimination of hazards to workmen, etc., have made these connectors first choice for dependable results. Let us send you an interesting booklet, "Positive Grip". It will give you complete performance data on this easily installed, better and more economical streamlined connector. Write today.

Electroline FIEGE CONNECTORS

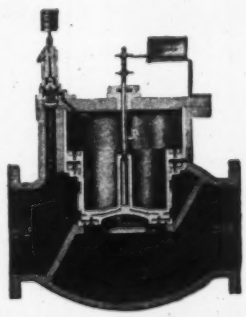
Electroline Company
4864 South La Salle Street Chicago, Illinois

Electric Double Cushioned Check Valve

This valve is for use in connection with remote tank storage service with valve located adjacent to motor centrifugal pump, also where a high-low pressure or float-operated switch located at tank is wired to the valve in order to accomplish complete automatic sequence of operation for starting and stopping the pump with respect to storage water levels.

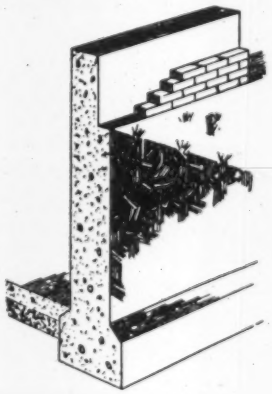
Sizes 3" to 36", angle and globe patterns.

Write for specifications.



GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

swivel the idler in a horizontal plane. If this in itself is not sufficient to cause the idler to swing enough to force the belt to throw back immediately, the belt will continue traveling to one side until it contacts the counterweighted end disc, which is slightly larger in diameter than the idler roll. Contact with the counterweight tends to rotate it, but since it is a counterweight it resists this tendency and produces a counterforce on the idler.— *The Chain Belt Co., Milwaukee, Wis.*



Footing Forms

A patented footing form which allows monolithic core for footing and walls, making the entire wall a one-operation job for forms and one pour has been developed. According to the maker, the process is a time- and money-saver for the contractor, and guarantees dry basement with poured concrete and the joints between wall and footing eliminated. Developed by Rocwall, Inc., the method has been tried and proven successful over a period of nearly four years by one of the largest residential concrete contractors in the Detroit area, the manufacturer says. The simplicity of the method is a major factor. There is no complicated footing or bolting to require an engineer on each job. A small crew of two foremen and four helpers can set forms for nine average 24x30 defense home foundations in six working days, and a crew of seven men pouring, tipping and finishing work together to provide nine or ten such basements per week. — *Rocwall Inc., 15439 Schaefer Road, Detroit, Mich.*

Corrugated Asphalt Siding

Corrugated asphalt siding, a new, non-critical building material, has been developed by Certain-teed Products Corp. The siding is designed for use on outside walls of temporary structures of all kinds, including factory buildings, warehouses, storage and machine sheds, or any building where corrugated metal siding might normally be used. Unique features of the material include the

YOU CAN'T PREVENT LIGHTNING—

BUT YOU CAN TAME IT

TO PROTECT VITAL WAR PRODUCTION!

VITAL war production must be maintained at all costs today. That is why the safeguarding of life and property against accident, sabotage, and even Nature's destructive weapon of lightning has taken on new importance.

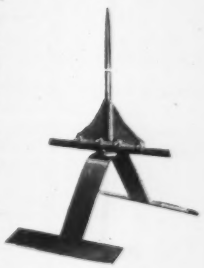
That is also why West Dodd Lightning Protection and static control equipment is being widely used on Army Ordnance Plants in all parts of the country. Helping protect ammunition loading lines, underground magazines, standard magazines, and bag loading buildings.

Many important industrial plants also have West Dodd protection on their power stacks.

WEST DODD PLUS FACTORS

West Dodd represents a consolidation of 12 old line manufacturers, including the famous Dodd & Struthers Company, pioneer of approved lightning protection. This wealth of experience and a long proved record of responsibility are two plus factors.

FREE assistance in planning installations and estimating costs. Telephone or telegraph today.



The West Dodd end aerial, complete. In center is the exclusive West Dodd cable and point connector. It eliminates sharp bends formerly necessary to bond aerial and conductor. Quicker to install. Eliminates a number of connectors. Simplicity adds to efficiency and longer life.

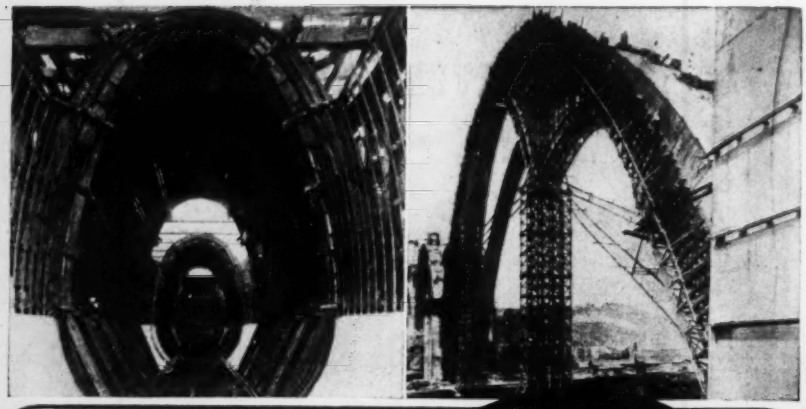
This is one of many West Dodd items developed to meet U. S. Government requirements, cut installation time, and save labor costs while aiming at more lasting, thorough protection.

TELEPHONE OR TELEGRAPH TODAY!

WEST DODD

LIGHTNING CONDUCTOR CORP.

GOSHEN, INDIANA



for Speed in Construction

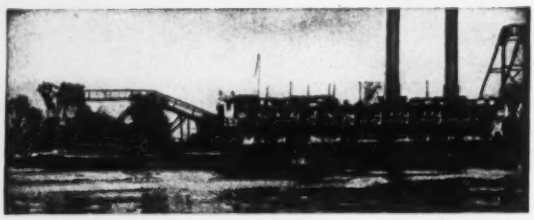
BLAW-KNOX STEEL FORMS

The rapid progress of engineering construction has naturally influenced the design of Blaw-Knox Steel Forms with respect to their general application and operation.

The engineering facilities and services extended by Blaw-Knox form engineers are prized by all who have taken advantage of them. These services are offered in the interest of engineering progress and are free from any charge or obligation.

BLAW-KNOX DIVISION
of Blaw-Knox Company
Farmer's Bank Bldg. Pittsburgh, Pa.
New York Chicago Philadelphia Birmingham

DREDGING



Filling, Land Reclamation, Canals and Port Works

River and Harbor Improvements
Deep Waterways and Ship Channels

We are equipped to execute all kinds of dredging, reclamation and port work anywhere in the United States

Contractors to the Federal Government

Correspondence invited from Corporate and Private Interests Everywhere

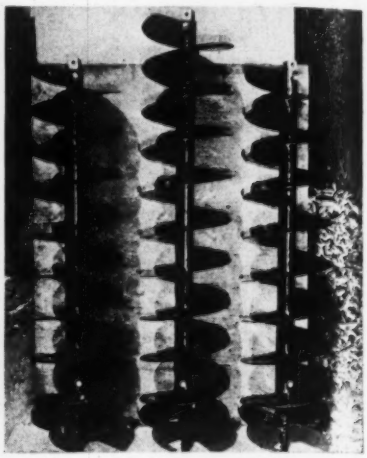
Largest Plant — Longest Experience

Atlantic, Gulf and Pacific Co.

21 Park Row
New York

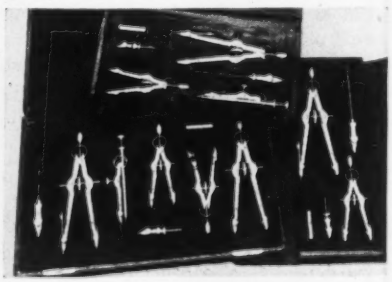
Houston, Texas
Scanlon Bldg.

fact that it is strong, lightweight, moisture-proof and durable; the corrugations will not flatten out during summer weather. The siding weighs approximately 12 ounces to the square foot, and individual sheets are easily handled or applied by one man. Sheets are 24 in. wide in lengths of 6, 7, 8, 9 and 10 ft.—*Certain-teed Products Corp., 120 S. La-Salle St., Chicago, Ill.*



Earth Borer

The K-M portable earth boring drills, made by Ka-Mo Tools, Inc., are said to be portable earth drills which combine the advantages of easy handling and quick assembly. The drills are furnished with hardened steel cutting head below screw and are available for boring holes 3 to 16 in. in diameter. Transportable by auto or truck, they are operated from an air compressor through air hose connections. Holes can be drilled vertically or at any desired angle, and in some of the most inaccessible places, as under viaducts, on tops of steel banks, behind fences, down in ditches. The drills have a special cutting head with adjustable cutting blade which allows the instrument to bore in sand, mud or clay without "grabbing."—*Ka-Mo Tools, Inc., 5525 West Ohio St., Chicago, Ill.*



Drawing Instruments

Available in three combinations of bows, drop bows, and pens, a new and complete line of American made drawing instruments has recently been announced by the V & E Engineering Co.

Attention

Contractors and Engineers

KALKTITE
(Asphaltic)
SEWER JOINT COMPOUND
(Used Cold)

NOW AVAILABLE

For Immediate Shipment!

If you are faced with a shortage of Sewer Joint Compound such as exists in certain sections of the country due to War conditions, you can proceed with your work without loss of time by using KALKTITE.

Large quantities of KALKTITE have been, and are now being used on Government sewer projects in all parts of the country. Some of these projects include:

- ★ **War Department Building**
- ★ **U. S. Air Corps Construction**
- ★ **Army Air Bases**
- ★ **Army Camp Construction**
- ★ **Ordnance Plants**

KALKTITE can be used in wet trenches—no delay because it sets up internally—even under water. KALKTITE is acid and root resisting and is easy to use by inexperienced labor. It has thoroughly proven its superior qualities during the 13 years it has been on the market. Get the facts *now* about KALKTITE, and its many advantages over other types of sewer joints.

PROMPT SHIPMENTS can be made today—write, wire, or telephone for quotation and complete information.

Also SULPHO-SEAL
Sulphur silicate compound — HIGHLY ACID RESISTANT FOR SEALING JOINTS IN VITRIFIED PIPE IN CHEMICAL PLANTS AND CEMENTING FLOOR TILE (priority required).

PRESSTITE ENGINEERING COMPANY
3940 Chouteau Avenue, St. Louis, Missouri

Design Does It and Gives You These Outstanding Advantages

THE ROTOVALVE design provides these unique advantages because the plug:

lifts, rotates and seats . . . assures through, unobstructed flow . . . provides minimum loss, as the loss through a Rotovalve, when open, is no greater than it is through a pipe of equal diameter and length . . . is obtainable in sizes from 6 to 60 inches, with controls that meet a wide-range of services . . . may be operated manually, hydraulically, or by motor.

Enjoy these advantages, just as modern waterworks and new war-material plants are benefitting by them! Specify ROTOVALVES for your next job—*and be doubly* sure!

S. MORGAN SMITH COMPANY YORK, PENN.

WILLIAMS *Buckets*

Welded Rolled Steel Construction

All types and capacities for all conditions. Send for Catalog.

The Wellman Engineering Company
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YOU'LL GET BETTER RESULTS WITH STERLING

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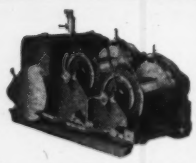


Simple, Dependable, Rugged—Sterling Hoists, Pumps, Light Plants are the choice of leading users.

STERLING MACHINERY CORP.
405-13 Southwest Blvd., Kansas City, Mo.

Sold under the trade name Vernco, these instruments are said to embody new and unique features of open truss design which increases strength and rigidity while cutting weight by 40 percent. This rigidity combined with absolute concentricity, it is pointed out, enables the user to describe extra-large, dense circles in pencil without the instrument yielding. Sets are available in one, two, and three bow combinations complete with dividers and pens, packed in velvet-lined leather cases.—*The V & E Engineering Co., Pasadena, Calif.*

Tester

The Model 520 insulation and breakdown tester shown above features a super-sensitive danger indicator which lights up to indicate leakage up to 1,000 megohms (1,000,000,000 ohms). Four voltage sources are available. No hand cranking and no adjustments are necessary. The model will also indicate shorts and opens, and as a safety feature includes a jewelled pilot lamp on the front panel which indicates when high voltage is on.—*Superior Instruments Co., 227 Fulton St., New York, N. Y.*

Recovery Unit

The installation of a Dorex recovery unit, supplied by Dorex Division of the W. B. Connor Engineering Corp., will result in conserving a large tonnage of metal on the original refrigeration installation and large quantities of electric current and fuel. Seven hundred Durex adsorber canisters, type 28H, have been installed in the cafeteria of the Sperry Gyroscope Co.'s plant in New York to treat 20,000 cfm of return air. Use of this installation leads to conservation of roughly 50 tons of installed refrigeration, and will later result in saving approximately 45,000 kw.hr. of electric current per season for cooling purposes, and approximately 40,000 gal. of oil per season for heating.—*W. B. Conner Engineering Corp., New York, N. Y.*

It's a basic principle of chemistry

HOT DIP GALVANIZING

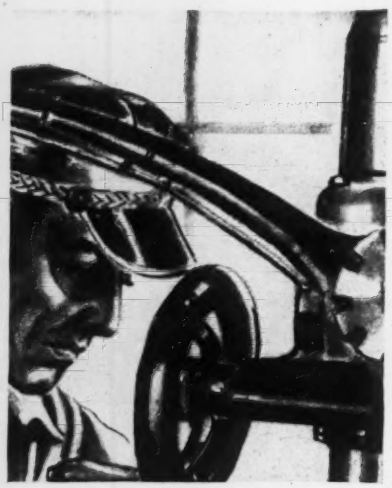
provides more rust protection per dollar

When steel is in perfect contact with zinc it *cannot* rust —not until *all* the zinc has first been corroded away . . . A few other metals also offer this sacrificial protection, but the application of them in an equally protective thickness would be too expensive. Hot Dip Galvanizing, by *alloying molten zinc* with the ferrous product, makes each an inseparable part of the other and guarantees a perfect contact between the two . . . Furthermore, the genuine Hot Dip Process, due to this alloying action, gives a much thicker, longer lasting zinc coating, and consequently *always* provides a far more perfect, more enduring rust protection at less cost . . . Know the truth about galvanizing. Write for literature.

AMERICAN HOT DIP GALVANIZERS ASSOCIATION, INC.
American Bank Building · Pittsburgh, Pennsylvania

IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

Acme Galvanizing, Inc., Milwaukee, Wis. ★ Acme Steel & Malleable Iron Works, Buffalo, N.Y. ★ American Tinning & Galvanizing Co., Erie, Pa. ★ Atlantic Stamping Co., Rochester, N.Y. ★ Atlantic Steel Co., Atlanta, Ga. ★ Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N.Y. ★ Diamond Expansion Bolt Co., Inc., Garwood, N.J. ★ Equipment Steel Products Division of Union Asbestos and Rubber Co., Blue Island, Ill. ★ The Fanner Mfg. Co., Cleveland, O. ★ John Finn Metal Works, San Francisco, Cal. ★ Galvanizers Incorporated, Portland, Oregon ★ Thomas Gregory Galvanizing Works, Maspeth, N.Y. ★ Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa. ★ James Hill Mfg. Co., Providence, R.I. ★ Hubbard & Co., Oakland, Cal. ★ Independent Galvanizing Company, Newark, N.J. ★ International-Stacey Corp., Columbus, O. ★ Isaacson Iron Works, Seattle, Wash. ★ Joslyn Co. of California, Los Angeles, Cal. ★ Joslyn Mfg. & Supply Co., Chicago, Ill. ★ L. O. Koven & Brother, Inc., Jersey City, N.J. ★ Lehigh Structural Steel Co., Allentown, Pa. ★ Lewis Bolt & Nut Co., Minneapolis, Minn. ★ Missouri Rolling Mill Corp., St. Louis, Mo. ★ The National Telephone Supply Co., Cleveland, O. ★ Penn Galvanizing Co., Philadelphia, Pa. ★ Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. ★ San Francisco Galvanizing Works, San Francisco, Cal. ★ The Sanitary Tinning Co., Cleveland, O. ★ Standard Galvanizing Co., Chicago, Ill. ★ Wilcox, Crittenden & Company, Inc., Middletown, Conn. ★ The Witt Cornice Company, Cincinnati, Ohio



Layne Quality

Has Set A World Standard!

Efficiency, Ruggedness and Long Life are the three outstanding and world recognized features of Layne Well Water Systems. Those features are the result of more than sixty years of water producing experience, specialized engineering skill and ceaseless endeavor to build better pumps and wells.

Thousands of Layne Well Water Systems are now serving, and have long served leading industrial plants, railroads, irrigation projects and municipalities throughout the United States and the Dominion of Canada. Hundreds also, are in use in foreign countries throughout the world.

Each Layne unit is designed and custom built to fulfill its particular task—the production of the largest quantity of water at the lowest possible operating cost. Various parts of the systems; pumps and component pump parts, motors, etc., are of standard manufacture and dimensions. Thus, repairs or replacements, when required, may be made at minimum cost. Each system is completed as a unit, then thoroughly tested and delivered in operation.

For literature showing superior construction and engineering details, address,

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Layne-Atlantic Company	Norfolk, Va.
Layne-Bowler New England Corp.	Boston, Mass.
Layne-Central Company	Memphis, Tenn.
Layne-Northern Company	Mishawaka, Ind.
Layne-Louisiana Company	Lake Charles, La.
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Layne-Ohio Company	Columbus, Ohio
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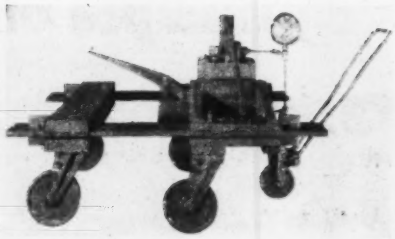
WORLD'S LARGEST WATER DEVELOPERS

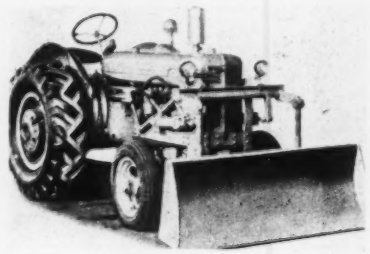


Portable Hydraulic Press

This portable hydraulic press can be adapted to many uses on construction projects such as for gears, sheaves, wheels, crank discs, and crank pins. The equipment can be used indoors or outdoors and is supplied with a lifting chain so it can be quickly slung up and taken down. This type of press is available in 60-ton capacity, 6-in. ram diameter, 850 lbs. standard bars, and in 100-ton capacity, 7¾-in. ram diameter, 1,550 lbs. standard bars.—*Vulcan Iron Works, Chicago, Ill.*

Bomb Extinguisher

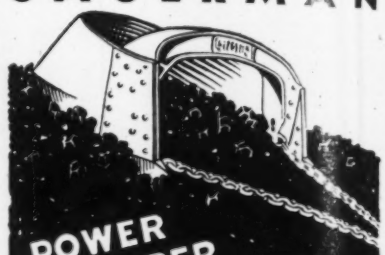
Cen-D-Out, a new extinguishing compound, has been developed by the Staten Island Chemical Corp. to combat possible fires caused by incendiary bombs in air attack. Perfected for treating magnesium and other metallic incendiaries, the product is packaged in a convenient size tube and is available for home or factory use.—*The Staten Island Chemical Co., 40 Exchange place, New York, N. Y.*



Baby Bulldozer

A small Baker hydraulic bulldozer, developed for use on light wheeled tractors, is being extensively used for finish-up work around camps and airports. It does the same kind of work accomplished by the standard Baker bulldozer, but on a small scale. Model 282, shown above, for International I-4 wheeled tractors, is hydraulically controlled, powered by a Baker rear-power take-off hydraulic pump unit. Blade is lifted and lowered by dual cylinders. Blade makes 6 in. deep cut. Moldboard can be raised 12½ in. and is 24 in. wide by 66 in. long. The speed, flexibility and size are said to adapt this product for use in mines and for quarry floors as well as the uses mentioned above.—*The Baker Mfg. Co., 501 Stamford Ave., Springfield, Ill.*

SAUERMAN



POWER SCRAPER

Because of its streamline design, a Sauerman Crescent scraper penetrates hard materials with the ease of a plowshare, and both in digging and hauling it requires much less line pull than any other scraper of equal capacity. It digs a heaping load in a few seconds, moves this load rapidly over the ground, dumps cleanly when it reaches the dumping point, and then returns at high speed to dig another load.

Write for catalog and see for yourself how others are cutting costs by using Sauerman scrapers for excavating, stockpiling and all long range material-handling work.

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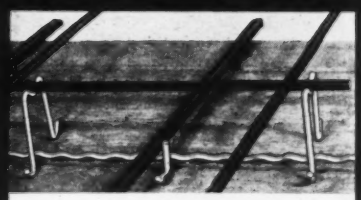

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COMBINATION SLAB BOLSTER AND CONTINUOUS HI-CHAIR

Unit supported on 5" centers. Hi-Chairs a minimum of 2" high. Available in 5' or 10' lengths. Complies with Federal specifications.

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Specialties

Hi-Chair, Screed Chairs • Bar Spacers, Beam and Slab • Ceiling Inserts • Shelf Angle Supports • Bar Ties, Wall Ties • Reed Clip Beam Wrapping • Sleeper Anchors • Paving Joint Units

Wide variety of designs for special uses. Write for catalog. See Sweets, Sec. 3-52.

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SEE OUR CATALOG IN SWEET'S

NEW PUBLICATIONS

Trail-Dump—A new catalog describing and illustrating the Model 120 Koehring Trail-Dump has been issued. The catalog has 50 illustrations, 16 pages in color, and presents the machine as a complete unit, with individual assembly illustrations, clearly depicting the operating functions and many special features. Mounted on rubber tires and suitable for high speed dirt hauling, the machine has proven to be exceptionally economical in maintenance.—*Koehring Co., 3026 West Concordia Ave., Milwaukee, Wis.*

Vibrators—An 8-page, completely illustrated booklet containing performance diagrams and ordering specifications has been issued by the Master Vibrator Co. The booklet describes various one-man units manufactured by the company, and shows them in use in many applications. —*Master Vibrator Co., Dayton, Ohio.*

Redwood—A timely, 8-page bulletin, entitled "Stepping Up War Production with Redwood," tells by picture and caption how versatile California redwood is serving in many uses important to the war effort. Published by the California Redwood Association, the booklet was especially prepared to acquaint engineers, architects and specification writers with situations where jobs are done better and quicker with redwood than with materials formerly used but now under war restrictions. — *California Redwood Association, 405 Montgomery St., San Francisco, Cal.*

Underground Magazines—The Caine Steel Co. has made available a brochure on continuous interlock portable steel underground magazines (igloo type) for the storage of munitions in safety. One advantage claimed for the product is the fact that it is completely fabricated in one plant and another is ease and speed with which it can be erected. Blueprints and photographs are available. — *The Caine Steel Co., 1820 No. Central Ave., Chicago, Ill.*

Manual—The McKenna Metals Co. has issued a 48-page "Kennametal Vest Pocket Manual," small in size for ready reference. The new manual contains chapters on selecting, designing, using, brazing and grinding Kennametal tools. Complete, easy-to-follow instructions show readers exactly how to get the utmost in service from all types of Kennametal steel-cutting carbide tools. The manual is further clarified by more than 100 illustrations.—*McKenna Metals Co., Latrobe, Pa.*

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DIAMOND MESH Is a Double ^ v

To obtain *Victory* we need *Volume*. To obtain Volume we must protect our *Materials* and *Man-Power*. Production Volume can't wait on accidents. Workers, Plant, Parts must have every safeguard. Steelcrete Expanded Metal DIAMOND MESHES *double* the safety factor wherever used. Available in a wide range of styles, with a full line of framing materials and accessories for easy fabrication.

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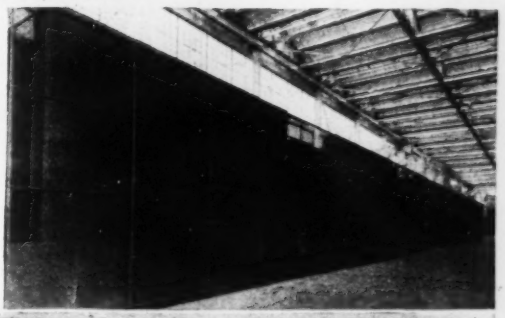

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Harness WISCONSIN AIR-COOLED HORSE-POWER to your Equipment

Wisconsin heavy-duty AIR-COOLED Engines bring to your equipment not only the most power per pound of engine weight, but also maximum power per cubic inch of piston displacement. And along with this you get heavy-duty service dependability, *plus* freedom from water-cooling problems. Wisconsin Engines know no seasonal limitations. They fit the machine, the job, the work location, and the weather.

Wisconsin Heavy-Duty Air-Cooled Engines are available in a complete range of sizes, from 1 to 35 hp., 1- and 4-cylinder models.

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There are four good reasons why Kerlow Open Steel Flooring is used so extensively on bridges and sidewalk openings. 1. *Safety* . . . open mesh, non-skid design provides slip-proof footing under all conditions. 2. *Light and Ventilation* . . . 85% of the floor area is open. This allows ample passage for light, heat, air and fumes. 3. *Permanence* . . . outlasts wood, steel plate or composition floors. 4. *Economy* . . . first cost is low, installation is simple and the only maintenance expense is occasional repainting.

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Lighting—A new lighting manual to meet the need for up-to-the-minute data on the use of lighting as a production tool is announced by the Benjamin Electric Mfg. Co. It is designed to provide executives, plant men, architects and engineers with the latest information on best methods of using lighting economically and efficiently. Main section of the guide is devoted to the solutions for the twenty-one lighting problems most commonly encountered in plants converting to war production.—*The Benjamin Electric Mfg. Co., Des Plaines, Ill.*

American Line—A revised edition of "The American Line," a 12 page reference catalog of the entire line of products manufactured by the American Foundry Equipment Co., has just been released. This illustrated catalog presents a complete summary of each of American's products and also includes operating views of typical installations of these products in leading industrial plants.—*The American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.*

Regulators—A new catalog covering Sarco self-operated temperature regulators for water heaters and industrial process applications has been issued. The 14-page bulletin contains numerous drawings and photographs to show installations and most economical means of operation.—*Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.*

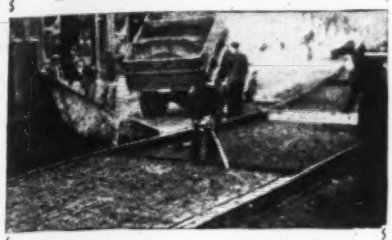
Bakelite—The April issue of *Bakelite Review*, containing interesting and pertinent matter relating to resin-bonded plywoods has just come off the presses. Handsomely illustrated, the publication includes a complete chart of the characteristics and methods of handling of plywood adhesives, as well as notice of many new applications of the plastic.—*Bakelite Corp., 30 East 42nd St., New York, N. Y.*

Steam Generator—Bulletin No. 1000, describing the unit steam generator produced by Preferred Utilities Company, Inc., has just been issued. The generator is a self-contained oil fired boiler plant completely assembled and mounted on skids ready for immediate installation. The product is a new one and has already been made for use by the armed services.—*Preferred Utilities Company, Inc., 33 West 60th St., New York, N. Y.*

Drills—A series of five bulletins, all illustrated and all containing engineering data and drawings, has been issued by the Keystone Driller Co., describing their blast hole, deep spudder, well drill, cleanout well drill, and water well drill machines.—*Keystone Driller Co., Beaver Falls, Pa.*

VIBER COMPANY CONCRETE

VIBRATION



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Here's a new Viber Vibrator especially adapted to fireproofing steel members, floor slabs, shallow girders, concrete floor beams and joists, precast concrete products. You'll find it sturdily constructed, vibrates in concrete 9500 r.p.m. has ½ h.p. motor. Also ideal for highways and bridges—for vibrating concrete along pavement headers, expansion and construction joints, and making reinforced concrete piles at the bridge site.

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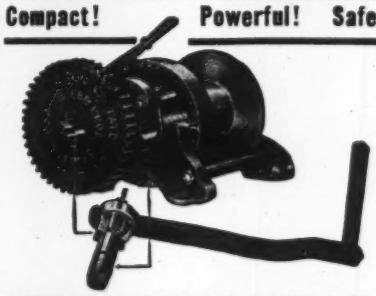

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1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.

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Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

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"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

Chart—A chart for quickly determining the drop in pressure accompanying the flow of air or gas through pipes of known diameter and length is being distributed by the De Laval Steam Turbine Co. For a given rate of flow through a pipe of given diameter, the chart gives a friction factor, from which the pressure drop is readily calculated by simple multiplication and division, taking into account the temperature, the specific gravity, and the pressure. An auxiliary alignment chart provides for reducing pipes of different diameters to equivalent lengths of a single diameter in order to simplify the calculation. *De Laval Steam Turbine Co., Trenton, N. J.*

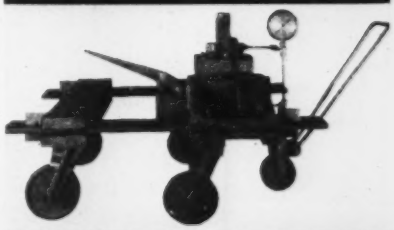
Blackout Ventilation—"Blackout your Windows But Not Your Ventilation" is the title of a new bulletin issued by the Ilg Electric Ventilating Co. Pointing out the acute need for ventilation in buildings with painted, closed, or otherwise blacked-out windows, the bulletin features a typical solution which has been engineered on the West Coast, showing how use of standard Ilg power roof ventilators, special blackout hoods and special fresh air inlet louvers were used as a solution to the problem.—*Ilg Electric Ventilating Co., Chicago, Ill.*

Conduits—Catalog "S," the Ric-wil Co.'s complete new catalog on underground and overhead prefabricated unit and tile conduit systems has just come off the press. This attractive two color 12-page engineering bulletin presents pictorial factory prefabrication views, as well as typical defense plant installations, where strength and speed of installation are required. Shown are typical conduit fittings, pipe supports, glands and prefabricated expansion loops complete with engineering details.—*Ric-wil Co., 1562 Union Commerce Bldg., Cleveland, Ohio.*

Compressors—A handsome 20 page bulletin describing a group of new portable compressors manufactured by the Chicago Pneumatic Tool Co. has just come off the press. Well illustrated, the bulletin introduces several new models, describing their specifications and many of their uses.—*Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.*

Reading Water—A new booklet on bottling department water problems has been issued by the D. W. Haering & Co., Inc. Scale and corrosion in bottle washers and pasteurizers and algae, slimes and odors occurring in pasteurizer operation are discussed, with methods of control. Protection of conveyors and chain drives are also phases of water control in such equipment. *D. W. Haering & Co., Inc., 205 W. Wacker Drive, Chicago, Ill.*

Adaptable to many uses on CONSTRUCTION PROJECTS



VULCAN PORTABLE *Hydraulic* PRESSES

MOUNTED ON WHEELS
EASILY TAKEN TO THE WORK

This valuable, economical performing, substantial multi-use machine not only saves time, but is highly efficient in the shop or out on the construction project.

Each press tested at our factory to rated capacity and must hold this pressure for more than 24 hours without appreciable drop.

Supplied with a lifting chain, these presses can be quickly slung up and taken down. Equipped with brass pump for added ruggedness and dependability. The gauge is graduated, indicating the total tons on the ram as well as the pounds per square inch.

Available in 60-ton capacity, 6-in. ram diameter, 850 lbs. standard bars, and in 100-ton capacity, 7¾" ram diameter, 1550 lbs. standard bars. Quotations will be given on special side bars.

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In every detail built for continuous heavy duty service . . . compact . . . lighter in weight . . . Murphy Diesels provide true operating economy and years of dependable performance.

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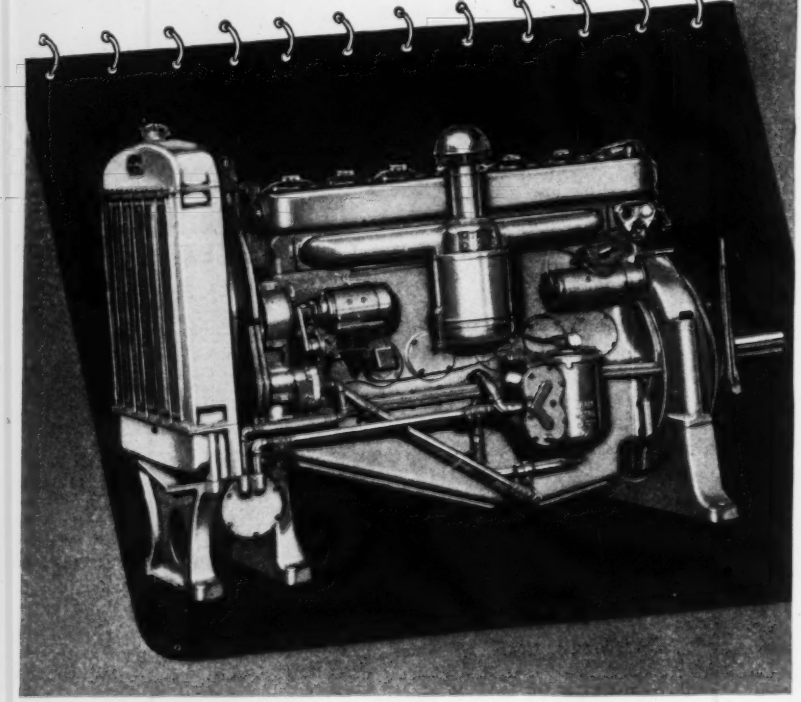

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Spur Gears—½ in. to 30 ft. in diameter
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STEAM TURBINES . . . HELICAL and WORM GEARS . . . PUMPS: Centrifugal, Propeller, Cloqless, Mixed Flow, Rotary Oil . . . Pump Priming Systems . . . CENTRIFUGAL BLOWERS and COMPRESSORS.

Manufacturers' Activities

R. R. GALLOWAY has been appointed vice president in charge of distribution for CERTAIN-TEED PRODUCTS CORP., according to a recent announcement. Mr. Galloway, who has been general sales manager of the company since August, 1940, will make his headquarters at Certain-teed's new general office at 120 S. La Salle St., Chicago. He has been associated with the company since 1923, and before his appointment as general sales manager, was manager of the Chicago District sales office.

The PHILIP CAREY MFG. CO., of Charlotte, N. C., has announced the opening of a contract department for applying high and low pressure pipe coverings in the two Carolinas.

T. FLOYD DREW, 50, assistant to the vice president of the CAROLINA POWER & LIGHT CO., died recently at Raleigh.

ROBERT C. WILKIN has been appointed Pacific Coast Manager for the PHELPS DODGE COPPER PRODUCTS CORP., making his headquarters at Los Angeles. Before his appointment, he was sales manager of building wires for the Habirshaw cable and wire division.

THE LINK-BELT CO. has announced the appointment of RICHARD F. BERGMANN (right) as chief engineer, with offices at Chicago; and WILLIAM W. SAYERS (left), as consulting engineer. Mr. Bergmann, recently chief engineer of the RAYON MACHINERY CORPORATION of Cleveland, Ohio, has been assistant to Mr. Sayers from 1933 to 1936. Mr. Sayers will occupy a newly created position as consulting engineer, where he will continue to deal with patent matters, and be available for consultation where his extensive knowledge of the company's engineering problems will be helpful. Mr. Sayers has been associated with the Link-Belt Co. for the last 39 years.

OUTPUT *starts with the* DIPPER

. . . AND HERE ARE 8 OF THE REASONS YOU CAN COUNT ON BIG OUTPUT WITH BUCYRUS-ERIE DIPPERS:

1. Struck capacity rating means full pay loads delivered each pass;
2. Inserted teeth and cutting lip are angled for easy penetration, and consequent fast filling;
3. Flared body and curved door shed loads fast;
4. Braces permit easy adjustment to best digging angle for varying materials;
5. Hoist attached well back leaves top clear to handle oversize;
6. Widespread handle attachments hold dipper firmly into the digging;
7. Protruding lip cuts clearance for dipper body, increasing filling speed, reducing wear;
8. Cross-sectional shape conforms to flow and pack of material, reducing voids, increasing pay load.

When you have a shovel job that demands big output fast, find out the full story on Bucyrus-Erie dippers.

B80

Bucyrus·Erie

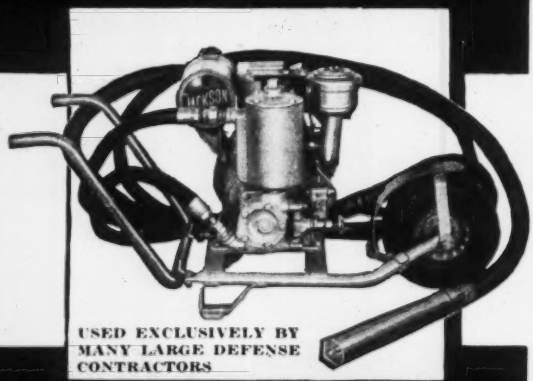
SOUTH MILWAUKEE, WISCONSIN

. . . If you want to make speed profitably . . . GET DEPENDABLE EQUIPMENT . . Buy the Fast . . .

JACKSON Hydraulic Concrete Vibrator

DESIGNED TO "TAKE IT" 3 SHIFTS A DAY—EVERY DAY

- Automatic pressure lubrication—requires no attention.
- 34-ft. hose—2¾" vibrator head.
- Adjustable frequency to 6800 R.P.M.—submerged in concrete.
- Powerful gas engine—4.7 H.P.
- Long-lived, ball-bearing, rotary, hydraulic pump.



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ELECTRIC TAMPER & EQUIPMENT CO.

LUDINGTON, MICHIGAN

How to protect people and property against danger from air attack—

THIS book gives a complete treatment of defense against air raids, showing the nature of destruction caused by them and what protection is possible, and describing the methods, equipment, and organization necessary to effect it. Based largely on experience in London and European cities, it gives the most authoritative possible view of civil air defense, making clear all aspects of the problem of protecting the population and industrial, business, and home properties, and fully outlining the means by which everyone, from state and municipal authorities to the individual citizen, may plan and carry out protective measures.

CIVIL AIR DEFENSE

By Augustin M. Prentiss
Lt. Col., General Staff Corps, U. S. Army

334 pages, 6 x 9, illustrated. $2.75

The book describes the various means and methods of air attack and the effects produced by each; contains details of blast and fragmentation effect of bombs, placing and structure of shelters, gas-proofing requirements, British Code governing construction of shelters, and other specific data of value to construction men.

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Send me Prentiss—Civil Air Defense for 10 days' examination on approval. In 10 days I will send $2.75, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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DENN M. BURGESS, vice president and general manager of R. G. LETOURNEAU, INC., is credited by the company with an idea expected to save a half-million pounds of rubber at LeTourneau alone in the next year. Mr. Burgess devised a method of cutting down crude rubber content of the 18x24 tires used on L.P. Carryall Scrapers by 25 percent. Savings in proportion will also be made in the manufacture of 16x20, 10x20 and 8.25x20 tires. Approximately 70 lb. of rubber will be saved on each 18x24 tire manufactured—60 pounds from the casing, 7 pounds from the tube and 3 pounds from the flap. The saving does not affect the load capacity of the tires but will cut estimated working life from 30,000 to 20,000 hours.

A. F. BOUCHER, district manager of the Detroit Office of the LINCOLN ELECTRIC CO., Cleveland, Ohio, has been called to active service with the U. S. Army. He will be succeeded by C. H. BUCKMASTER of the company's Pittsburgh Office, and J. H. CUNNINGHAM of the Detroit Office will take over Mr. Buckmaster's duties.

THE SAFWAY STEEL SCAFFOLDS CO. OF WISCONSIN, INC., of Milwaukee, has changed its name to SAFWAY STEEL PRODUCTS, INC.

JAMES T. GERAGHTY, 38, sales engineer for the Manhattan Rubber Mfg. division of RAYBESTOS-MANHATTAN, INC., died recently at Chicago.

W. F. MUNNIKHUYSEN, vice president of the KOPPERS CO. in Pittsburgh, has been elected a member of the board of directors.

ANDREW FISCHER, JR. has been elected executive vice president and director of JAMES STEWART & CO., INC., New York contractors.

LESTER M. GOLDSMITH, chief engineer of the ATLANTIC REFINING CO., recently was granted the honorary degree of Doctor of Science by Drexel Institute of Technology, Philadelphia. Mr. Goldsmith was cited as "an engineer of national distinction, particularly in the field of petroleum transportation, and an authority on the propulsion of ships by both diesel engines and steam turbines."

MEETINGS

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, University of Minnesota, Minneapolis, Minn., July 22–23.

REGIONAL AND LOCAL MEETINGS

PENNSYLVANIA SEWAGE WORKS ASSOCIATION, annual conference, Carlisle Sewage Treatment Plant, Carlisle, Pa., and Penn-Harris Hotel, Harrisburg, Pa., August 25–26.

PENNSYLVANIA WATER WORKS OPERATORS' ASSOCIATION, annual meeting, Penn-Harris Hotel, Harrisburg, Pa., August 27.

LEAGUE OF NORTH DAKOTA MUNICIPALITIES, Dickinson, N. D., Sept. 14–16.

NORTH DAKOTA WATER AND SEWAGE WORKS CONFERENCE, Great Northern Hotel, Williston, N. D., Sept. 17–19.

Elections and Activities

TRIBUTE to members of the Raleigh, N. C., Engineers Club who are now in the armed services was paid at a meeting of the club recently. The meeting was the last regular session of the organization for the summer, monthly meetings to be resumed in October. Twenty-four members are now in the armed services.

T. M. FRANCIS was elected chairman of the American Society of Mechanical Engineers, Birmingham Section, at an annual dinner and meeting. Other officers elected were Harry Mouat, vice chairman, and Abbott H. Blair, secretary.

S. J. WILLIAMS, superintendent of the Menominee water and sewage department, was elected president of the Upper Michigan Water Works Association at an annual convention held at Iron Mountain. Other officers elected were Prof. E. F. Wiedenhoefer, Michigan College of Mining and Technology, vice president; Sidney Shank, Escanaba, secretary-treasurer; C. L. Mosher, Marquette, and Jack Rubbo, Iron Mountain, trustees.

W. O. SPENCE, of Sanford, head operating engineer of the filter plant at Fort Bragg, N. C., was elected president of the North Carolina Water Works Operators Association at the annual four-day short course for water works operators held at Raleigh. Other officers named include: D. W. Ireland, of Burlington, vice-president; H. D. Fesperman of Albemarle, secretary and treasurer; P. L. Abernathy of Hickory, chairman of the

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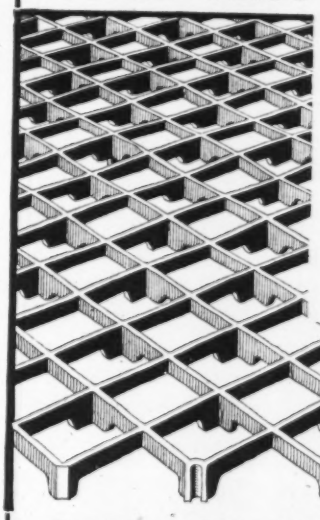

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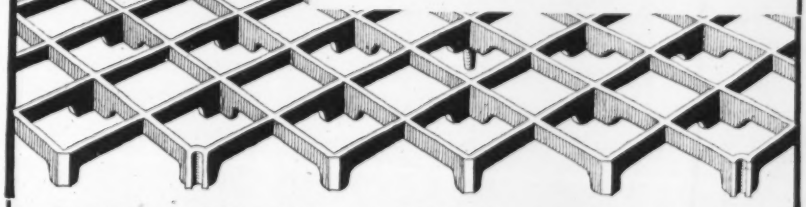

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nominating committee, and T. E. Witty, of Thomasville, member of the examining board. Approximately 61 waterworks operators from all parts of the State registered for the course, which was sponsored by the Association, the North Carolina State Board of Health, and the North Carolina State College Extension Division. Laboratory work, which dealt with bacteriology, chemistry and microscopy was under direction of Dr. E. E. Randolph, head of the Department of Chemical Engineering at North Carolina State College; Dr. I. V. Shunk, Dr. M. F. Buell, and Prof. W. S. McKimmon.

THE Birmingham Engineers Club elected the following new officers at a recent annual meeting: Percy G. Cowin, president; Arthur J. Blair, vice-president, and E. D. Scott, secretary-treasurer. Ralph Y. McIntyre, Paul Wright and T. M. Francis were elected members of the board of directors.

"ELEMENTARY Soil Fundamentals" was the subject of a luncheon talk given before members of the Fort Worth, Texas, Geological Society by H. S. Gillette, senior highway engineer, U. S. Public Roads administration. Mr. Gillette has been engaged in a study of problems dealing with military airport constructions.

ABOUT 200 contractors from Texas, Oklahoma, Louisiana and New Mexico attended a meeting with 75 officers of the Corps of Engineers in Dallas, Texas, recently, to discuss new contracts to be advertised soon by the Southwestern Division of the Corps. Projects will include grading and paving, building construction and utilities installations. Associated General Contractors sponsored the sessions.

GEORGE P. NACHMAN, of Cleveland, was elected president of the Heating, Piping and Air Conditioning Contractors' National Association at its sixtieth annual convention held recently in Milwaukee. Other officers elected were: vice-president, Daniel Hayes, San Francisco; treasurer, Louis F. Hudepohl, Cincinnati, and secretary, Joseph Fitts, of New York.

W. H. STUEVE, city engineer for the Oklahoma Gas & Electric Co., is the new president of the Oklahoma Engineer Club. Other officers are Ralph Randall, first vice president; J. W. Rogers, second vice president, and M. J. Haris, secretary-treasurer.

THE ASSOCIATION OF POLISH ENGINEERS in Canada held its first annual meeting in Ottawa recently. One hundred out of the 120 members of the association attended.

LAWRENCE PUMPS

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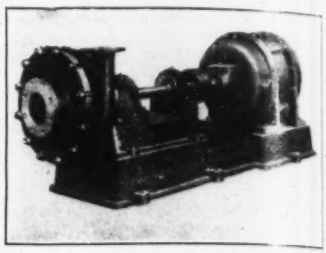

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MEN AND JOBS

Arthur C. Everham, director of public works at Kansas City, Mo., recently celebated his 40th anniversary as an engineer.

W. W. Baker, city engineer; **W. F. Campbell,** city building inspector, and **Fleet Hall,** superintendent of streets and sanitation, were reappointed by the Fayetteville, N. C., board of aldermen, recently.

Earle W. Sudderts, senior sanitary engineer for Dallas county, Texas, has been named to take charge of classes in progress in the engineering school of Southern Methodist University for municipal employees of the communities of Garland and Grand Prairie war industry site.

C. L. Cleason has been promoted to district engineer for the Iowa State Highway Commission at Ames. He succeeds **A. A. Baustian,** who recently joined the Army Corps of Engineers.

Emmon Robbins, city engineer at St. Francis, Kans., has been appointed Thomas county engineer with headquarters at Colby.

Henry Schlitt of Lincoln, Nebr., has been appointed bridge engineer for the Nebraska state highway department, succeeding the late Glen Mason.

Robert Gaston, Grundy Center, Ia., assistant county engineer for Grundy county, has resigned to accept a position with the Stanley Engineering Co. at Muscatine, Ia.

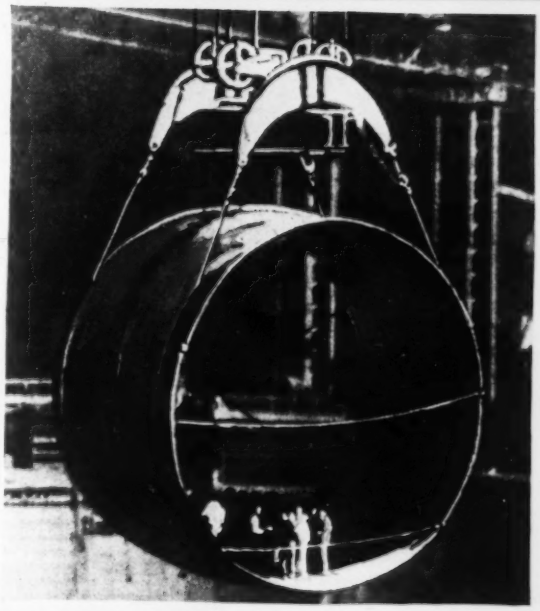
Arthur D. Morrell, of Palmyra, Nebr., for several years with the Nebraska Department of Roads and Irrigation and later state WPA engineer, has been ordered to report for duty as a Major in the Corps of Engineers.

Charles Chaney, engineer with the Montana state highway commission for the past 12 years, has resigned to join the Corps of Engineers.

Ward Green, draftsman for the South Dakota Highway Commission for the past 19 years, has resigned to take a position as architectural draftsman with Hugill and Blatherwick, architects, at Rapid City.

Herbert I. Collins, a senior civil service engineer with the United States District Engineers Office at Mobile, Ala., has been made a Lt. Col. in the Corps of Engineers.

There are no Substitutes for HOISTS



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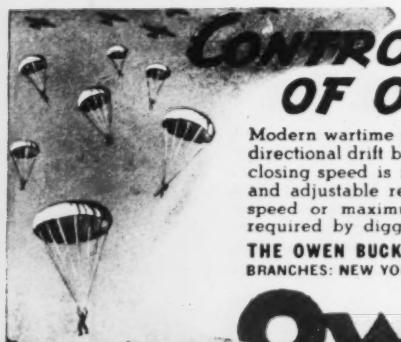

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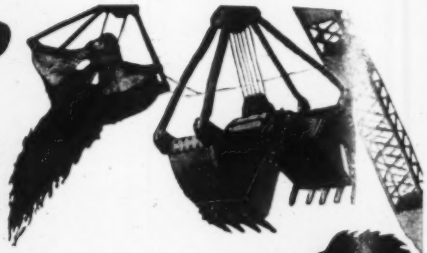

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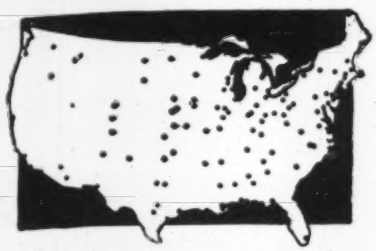
Location of ENR Correspondents



Symbols and Abbreviations Include

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily
A-E-M Architect — Engineer-Management type of contract.

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply — Unclassified
Sewers, Waste Disposal — Latin America
Bridges, Grade Cross'gs — Public Buildings
Streets & Roads — Commercial Buildings
Earthwork, Waterways — Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR):

LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

Note: To comply with censorship requirements, addresses on some reports are being generalized. Data which would reveal the purpose of the improvements and the size are withheld. The name of contractor and general area are reported.

WATER SUPPLY

PROPOSED WORK

★**Calif., Lake Merced**—City and County of San Francisco, City Hall, San Francisco, voted bonds auxiliary pump. plant. $1,250,000.

Colo., Denver—City, 30,000 ft. 12¾ in. watermains. $196,000. F. O. Ray, city engr.

★**†Mich., Detroit**—Wayne Co., Rd. Comm., 3800 Barium Tower, waterworks, Wayne. $348,000. **FWA.**

N. Y., Farmingdale—F. G. Murray, mayor, addnl. water facilities, imprvs. $58,159 appropriation. Applied for $29,000 FWA gr. CD 5/28—ENR 6/4.

Tex., Austin—City, c/o T. Miller, mayor, 5 mi. water pipeline, $90,000. M. Turner, Water Dpt., engr.

B. C., Saanich—Waterworks sys., in Brentwood area. $29,000.

N. S., Farmouth — Municipality, pipeline from Lake George. $40,000.

Ont., Byron—Westminster Twp., Byron, WW sys. exten. $22,000.

BIDS ASKED

Bids Asked July 8

†Arkansas—U. S. Eng., Gay Bldg., Little Rock, water and sewer facilities. $300,000.

Bids Asked July 10

†Arkansas—U. S. Eng., Gay Bldg., Little Rock, sprinkler sys. $22,000.

Bids Asked

†Tex., Garland—City, J. R. Stultz, secy., water distr. sys. exten., Tex. 41-460. $86,744. **FWA.** H. B. Gieb & Co., 1207 Texas Bank Bldg., Dallas, engrs. CD 6/15—ENR 6/18.

Ont., Preston—Water Comn., F. Pelz, chrn., addnl. water wells. $18,000.

LOW BIDDERS

†California—U. S. Eng., Wright Bldg., Sacramento, June 24, water sys. Inv. 63, from J. Hachman, P. O. Box 206, Stockton, **$69,725.** CD 6/18.

†Calif., Vallejo—Federal Works Agency, 408 S. Spring St., Los Angeles, June 26, pumphouse and pipeline for water sys., Docket 4-126, Unit 2, Contr. 3, Bid 6, RE-69, and Swanzy reservoir imprvs. for water sys. Docket Calif. 4-126, Unit 2, Contr. 1, Bid 6-RE-66, from Adam Arras & Son, 666 Mission St., San Francisco, **$27,709** and **$69,792** respectively***Swanzy reservoir gunite lining, Docket Calif. 4-126, Unit 2., Contr. 2, Bid. 6-RE-68, from A. Sordal, 722 Magnolia Ave., Long Beach, **$72,150.** CD 6/16—ENR 6/18.

La., Greenwell Springs—State, Dpt. Finance, Div. Purchases, Baton Rouge, water treatment plant, Greenwell Springs Hospital, PR 45841 CEE. from L. W. Eaton, Triad Bldg., Baton Rouge, **$30,212.**

†N. H., Portsmouth—City, 126 Daniels St., June 19, watermain, Cont. 3, N H. 27-104, from Landers & Griffin, High St., **$83,900. FWA.** CD 6/9—ENR 6/11.

†Texas—U. S. Eng., Federal Bldg., Galveston, water distr. lines, facilities, from Race-Marshall Const. Co., 4005 Center St., Houston, **$43,400.** CD 6/17—ENR 6/25.

†Tex., Amarillo—City, WW pipeline, Tex. 41-498, from Williams & Whittle, 542 Mockingbird Lane, Dallas. **$350,696. FWA.** CD 5/15—ENR 5/21.

CONTRACTS AWARDED

★**†Arkansas**—U. S. Eng., Box 97, Memphis, Tenn., water pump. sys., storage and treatment plant, Inv. 1092-42-204F, to Creech Constr. Co., University City, Mo. Est. less than **$1,000,000.**

†Arkansas—U. S. Eng., Gay Bldg., Little Rock, water distr. sys., to E. V. Bird Constr. Co., Fayetteville. Bids 6/19, awarded 6/23. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs. CD 6/10.

†California—U. S. Eng., 751 S. Figueroa St., Los Angeles, water supply sys., No. 556, to C. J. Paradis, 2320 Idell St., Los Angeles. Est. over **$15,000.** Bids 6/22, awarded 6/23.

†California — U. S. Eng., 751 S. Figueroa St., Los Angeles, water and sewer lines, No. 552, to R. A. Wattson Co., 1026 N. McCadden Pl., Los Angeles. Est. over **$25,000.** Bids 6/19, awarded 6/14.

†Calif., Marin—Fed. Works Agency, 408 S. Spring St., Los Angeles, furnishing materials, c.i. pipe, fittings, etc., for construction water sys. exten. Docket Calif. 4-242, Bid 6 RE 67, to U. S. Pipe & Fndry Co., Monadnock Bldg., San Francisco. **$179,003.** Awarded 6/22.

★**†Florida**—U. S. Eng., Courthouse & Postoffice, Jacksonville, water distr. sys. and sewage collection, Inv. 436-42, to Cleary Bros. Constr. Co., Georgia Ave., West Palm Beach, less than **$1,000,000.** Awarded 6/19.

N. M., Raton—R. Gaskin, city clk., reconstructing water distr. sys. **WPA. $42,770.**

★**†Ohio**—U. S. Eng., 700 Guardian Bldg., Detroit, Mich., watermains, water services, etc., to G. H. Leach Co., Degraff, under **$1,000,000.**

Tenn., Nashville—11,900 ft. 16 in. 150 # c.i. bell and spigot water mains, to Volz Constr. Co., Ripley. **$29,539.** F. Beasley, city engr.

†Texas—U. S. Eng., Fort Sam Houston, water lines, facilities, and sanitary sewers, Spec. 42-120, to Engineering Contractors, 1508 Fredericksburg Rd., San Antonio, **$27,900** and **$46,200** respectively. CD 6/16—ENR 6/18, under Public bldgs.

†Texas—U. S. Eng., Citizens Bank Bldg., Denison, water imprvs., facilities, to C. K. Howard & Co., 2500 N. Bway., Oklahoma City, Okla. **$236,000.**

Ont., Ottawa—Dpt. Natl. Defense for Air, water storage reservoir, watermains at R. C. A. F. Station, Rockcliffe, near here, to Simard Bros., Ltd., 219 York St., **$44,000.**

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Ariz., Tucson — C. C. Irvin, city clk., sewage disposal plant. $160,000. Applied for Federal funds.

★**†Conn., Bridgeport**—Peter Brewster, dir. P. Wks., Bridgeport, trunk sewers. $650,000. **FWA.** H. L. Rowland, City Hall, engr.

Conn., Stratford—P. Wks. Dpt., Town Hall, storm and sanitary sewers, Mercer St., Glenwood, Rosedale, Fairview Aves., etc. $25,000. Matthew Jankowski, town engr.

†Md., Cabin John — Pub. Bldgs. Admin., North Interior Bldg., Wash., D. C., outfall sewers. $45,000.

★**Miss., Pascagoula**—City, c/o Mayor and Councilmen, did not open bids June 16, sewer exten. $585,835. Will readvertise. CD 6/10.

O., Cleveland—Sewers in Fernciff, Harwell, Fairmont and Westport Aves. $50,000. J. C. Wenrick, City Hall, engr.

O., Euclid (Br. Cleveland)—Benton Building Co., B. Lefton, pres., 790 E. 260 St., soon lets contract storm and sanitary sewer for housing. $40,000.

†Tex., Wichita Falls—J. Bryan Miller, city mgr., received no bids June 15, sewers, Tex. 41-167. $118,000. **FWA.** Will readvertise. CD 6/4—ENR 6/11.

Utah, Ogden—Storm sewer, Wall, Quiney and Jackson Ave. area. $80,000. W. Templeton, city engr.

★**†Va., Hampton Roads**—Hampton Roads Sanitation Comn., $6,500,000 bond election July 21, sewage disposal plants, sewerage lines. $20,000,000. **FWA.** CD 10/8—ENR 10/16.

†Va., Newport News—City, exten. sewerage sys., incl. pump. station, outfall sewer, connecting lines. $127,000. **FWA.**

†Va., Norfolk—City, exten. sewerage sys. $70,100. **FWA.**

★**†Va., Portsmouth** — City, force mains, small pump. station, suction well, suction mains, $227,000; sewerage sys., $556,500. **FWA.**

Alta., Claresholm — Municipality, C. J. Amundsen, clks, sewerage sys. $35,000. J. Haddin, 9 Argyle St., Calgary, engr.

Que., Beauport—Municipality, c/o O. Bedard, clk., sewerage and WW sys. exten. $40,000.

BIDS ASKED

Bids Asked July 7

Ill., Monsanto (P. O. East St. Louis)—Village, c/o L. Sauget, pres. Bd. Village Trustees, G. Ogden, village clk., rein.-con. box sewer lined with vitr. clay liner plates, exten. along line south of and parallel to existing sewer from Mississippi River to east line of Gulf, Mobile & Ohio Ry. and 36 in. vitr. clay sewer encased in rein.-con. from sewage lift station to east line of Terminal Railroad Assn. tracks, etc. B. C. McCurdy, County Hy. Bldg., Belleville, engr.

†Tex., Garland—City, sanitary sewer exten., Tex. 41-461. $37,214. **FWA.** H. B. Gieb & Co., 1207 Texas Bank Bldg., Dallas, engrs. CD 6/18—ENR 6/25.

Bids Asked July 8

Ont., Mount Hope (Hamilton)—Secy. Dpt. Munitions & Supply, Ottawa, sewage disposal plant at air training base, for Dpt. National Defense for Air, Ottawa. $35,000.

Ont., Trenton—Secy. Dpt. Munitions & Supply, Ottawa, sewage disposal plant addn., R.C.A.F. sta. for Dpt. National Defense for Air, Ottawa. About $30,000.

Bids Asked July 10

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, sewer basin and inlet, Avenue V and E 5 St.

Bids Asked July 20

†Mississippi—U. S. Eng., Courthouse, Mobile, Ala., mechanical equip. for sewage treatment plant.

Bids Asked

†Texas—U. S. Eng., Fort Sam Houston, sewage treatment plant, Spec. 42-160.

LOW BIDDERS

Md., Baltimore—City, Bd. Awards, City Hall, June 24, installing storm water drains, Contr. 192, from J. Matriciani, 209 S. Exeter St. **$52,482.** CD 6/17.

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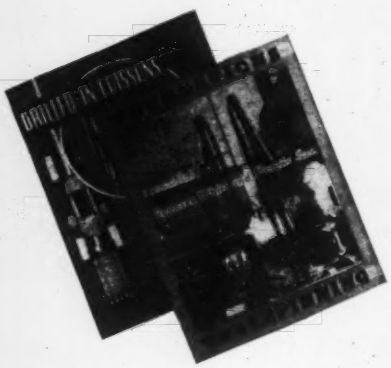

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SEWERS, etc. (Low Bidders, Co[illegible]

†Texas—U. S. Eng., Federal Bldg., [illegible] sanitary sewer lines, facilities, fro[illegible] shall Const. Co., 4005 Center S[illegible] **$73,000.** CD 6/17—ENR 6/25.

CONTRACTS AWARDED

†Arkansas—U. S. Eng., Gay [illegible] Rock, sewage disposal plant, to [illegible] Oshkosh, Wis. **$300,000.** CD 6/[illegible]—ENR 6/18.

†California—U. S. Eng., 751 S. [illegible] Los Angeles, sewage treatment [illegible] No. 562, to General Constr. Co., A. J. Johnson, 5205 Hollywood Blvd., L[illegible] Est. over **$25,000.** Bids 6/23.

N. J., Bloomfield—Town, Town Hall, Sherling, vitr. tile sanitary sewer ext[illegible] Ave., Melrose Terrace, Brick and [illegible] **WPA. $112,496.** C. Malstrom, [illegible] N. 6 Sts., Newark, WPA engr. CD 6/[illegible]—ENR 6/18.

N. J., Secaucus—Town, Town Hall, [illegible] 20-in. vitr. tile sanitary sewers, [illegible] catch basins, **WPA. $62,500.** C. [illegible] Orange and N. 6 Sts., Newark, WPA engr. CD 6/11—ENR 6/18.

O., Medina — Village Council, extend sanitary sewerage sys. to Shullo Constr. Co., Home St., Akron, **$28,502.** Est. $[illegible] Awarded 6/23.

†Tex., Longview—U. S. Eng., Citizens Bank Bldg., Denison, to A. M. Campbell & J. Kay, Tyler, sanitary sewer collecting lines, facilities, **$86,000;** water distr. lines, facilities, **$62,000;** installing natural gas distr. sys. facilities, **$34,000,** all foregoing Inv. [illegible] 210. Grand total $182,000. Bids 5/[illegible] CD 5/21.

BRIDGES—GRADE CROSSINGS

PROPOSED WORK

California—State Div. Hys., P. Wks. Bldg., Sacramento, rejected bids June 17, 1[illegible] span bridge, 116 timber trestle spans, 19 ft. [illegible] concrete piers over Napa River, west [illegible] limits, Vallejo, Solano Co. CD 6/27—ENR 6/25, under LB.

Ill., Chicago—Dpt. P. Wks., O. E. Hewitt, comr., constructing, reconstructing portions [illegible] Pulaski Rd. bridge, $35,000; S. Cicero Ave. bridge, $35,000; S. California Ave. bridge, $35,000; S. Pulaski Rd. viaduct, $40,000.

Ind., Fort Wayne—City, State Hy. Comm., Indianapolis, and New York, Chicago & St. Louis R. R., A. C. Harvey, ch. engr., Terminal Tower, Cleveland, O., underpass. $[illegible] (**Correction**-cost) CD 6/15—ENR 6/18.

Missouri—State Hy. Comm., Jefferson City, received no bids June 26, 18 ft. rein.-con. culvert, Newton Co.; one 160 ft., two 100 ft. rein.-con. arch spans, four 50 ft. and one 45 ft. rein.-con. deck girder spans, etc., Pulaski Co. CD 6/16—ENR 6/18.

North Carolina—State Hy. & P. Wks. Comm., Raleigh, widening bridge over Drowning Creek, Richmond and Moore Counties. $25,000. W. V. Baise, Raleigh, engr.

Oregon—State Hy. Comm., Portland, received no bids June 25, bridge over South Umpqua River, Douglas Co. Will readvertise. CD 6/[illegible]

BIDS ASKED

Bids Asked July 1

Mo., St. Louis—C. H. Ellaby, pres. Bd. Pub. Serv., 304 City Hall, cleaning, painting portion eastern approaches to Douglas MacArthur Bridge over Mississippi River, $35,000.

Bids Asked July 15

California—State Div. Hys., C. H. Purcell, engr., Sacramento, widening existing bridge over Grapevine Creek, Kern Co. Over $25,000.

Bids Asked July 16

California—State Div. Hys., State Bldg., Los Angeles, rein.-con. bridge over Day Canyon Flood Channel, San Bernardino Co., over $25,000; 0.5 mi. rein.-con. box culvert and approaches, graded and paved with concrete at Beetox over Beardsley Channel, Ventura Co., over $25,000. C. H. Purcell, P. Wks. Bldg., Sacramento, state hy. engr.

Bids Asked

★**†Oklahoma**—U. S. Eng., Citizens Bank Bldg., Denison, Tex., bridge over Washita River and relocating Hy. 70. $600,000.

LOW BIDDERS

D. C., Wash.—District Comrs., District Bldg., June 19, imprv. approaches to grade separation, 14 St. and Maine Ave. S.W., part 1, approaches, part 2, Maine Ave., from Corson & Gruman Co., 33 and K Sts. N.W., **$159,481** and **$59,245** respectively.

Kan., Kansas City—Chicago Rock Island & Pacific Ry. Co., W. H. Hillis, asst. ch. oper. officer, La Salle St. Sta., Chicago, Ill., Union

BRIDGES, etc. (Low Bidders, Cont'd.)

Pacific R.R., B. H. Prater, ch. engr., 1416 Dodge St., Omaha, Neb., and City of Kansas City, Kan., June 23, repairing 18 St. viaduct, from J. A. Tobin Constr. Co., 3700 Rainbow Blvd., Kansas City, Kan., **$71,429.** CD 6/9—ENR 6/11.

Nebraska — State Dpt. Road & Irrigation, Lincoln, June 25, viaduct and guard rail on 2.3 mi. Cheyenne Co., from Bushman Constr. Co., 1801 S. 8 St., St. Joseph, Mo., **$32,595.**

CONTRACTS AWARDED

Connecticut—State Hy. Dpt., Hartford, toll house and admin. bldg., also concrete tunnel toll house, islands, etc., Thames River Bridge between Groton and New London, to Eastern Constr. Corp., 98 Lyon St., New Haven, **$28,450** and **$42,154** respectively. Bids 5/25. CD 5/28—ENR 6/4, under LB.

Oregon—State Hy. Comn., Portland, June 25, Judkins Point overcrossing on Pacific Hy., Lane Co., to Barnham Bros., Salem, **$78,192.** Bids 6/25. CD 6/16.

N. B., Tracadie—C. A. MacVey, engr. Dpt. P. Wks., Fredericton, bridge over Big Tracadie River (mouth) Tracadie-Newcastle Rd., to Diamond Const. Co., Ltd., Royal Bank Bldg., Fredericton, about **$100,000.** Bids 6/10. CD 6/2—ENR 6/4.

STREETS AND ROADS

BIDS ASKED

Bids Asked July 7

Ill., Charleston—Coles Co., concrete paving 1.0242 mi. Sect. 7 MFT and 1.0227 mi. Sect. 11-CS. G. H. Baker, Centennial Bldg., Springfield, state engr. co. roads and city streets.

Maryland—State Roads Comn., Baltimore, grading, draining, gravel surfacing 2.31 mi. hy. between Millington and Chesterville-Crumpton Rd., Kent Co., Contr. K 133-1-250; 2.061 mi. hy. along Marlburg-Pisgah Rd., Charles Co., Contr. Ch. 220-1-550.

Ohio—State Hy. Dpt., Columbus, asphaltic concrete resurfacing 4.05 mi. Sects. B and B-1 of SH 133, US 30-N, Allen Co., $30,520; 6.271 mi. Sects. Painesville and J of SH 2, US 20, Lake Co., $5,300; concrete repairing 3.787 mi. Sects. Ripley and S-1 of SH 7, US 52, Brown Co., $27,400; grading, draining, tar concrete resurfacing 1.816 mi. Sects. Napoleon, P-1 and P-2, Henry Co., $66,800; grading, brick and concrete paving 0.736 mi. Sects. Toledo and A of SH 909, Lucas Co., $101,500; aggregate treatment 10.35 mi. Sects. B-1, B-2, Batesville, C, D and E-2 of SH 392, Noble Co., $11,442; bituminous premixed surface course resurfacing 3.274 mi. Sect. G of SH 258, US 50, Ross Co., $38,400.

Virginia—Dpt. Hys., Richmond, concrete paving 2.3 mi. Route 236, S.P. DA-WR-368-AR1, etc., Federal Proj. DA-WR-11-A, Fairfax Co.

Virginia—Dpt. Hys., Richmond, concrete paving and overpass 1.9 mi. Route 13, S. Proj. DA-NR-1284-A2, B6 and Fed. Proj. DA-NR-1-B(1) Norfolk Co.

Bids Asked July 10

Louisiana—Dpt. Hys., Baton Rouge, concrete paving 9.06 mi. Camp Claiborne-Le S. P. 840-21-01 and 416-01-01 FA Projects DA-WR 8 (1) and AW-FAS 27-A, (1), Compte Hy., State Routes C-2070 and C-2081, Rapides Parish; 6.207 mi. Fillmore-Doyline Hy., State Routes 560 and C-2083, S. P. 122-01-03, 122-02-02 and 122-03-02 Proj. DA-WI 7, FA Second. Proj. A1-FAS 76 (1), Bossier and Webster Parishes.

Bids Asked July 13

Wis., Wauwatosa—W. T. Whipp, city clk., concrete paving, bituminous surfacing Parkview Court, Swan and Wilson Blvds., Memomonee and Martin Drives, W. State, N. 93, N. 94, N. 96 Sts., 3 alleys. M. F. Linman, city engr.

Bids Asked July 15

Arizona—State Hy. Comn., Phoenix, grading, draining, aggregate base course 2 mi. Duncan-Clifton Hy., Greelee Co. Over $50,000. W. R. Hutchins, Phoenix, engr.

California—State Div. Hys., C. H. Purcell, engr., P. Wks. Bldg., Sacramento, grading, crusher run base and plant mixed surfacing 3 mi. Nevada and Sierra Counties, over $25,000; 4.2 mi. Siskiyou Co., over $25,000.

Bids Asked July 17

Kentucky — State Dpt. Hys., Frankfort, grading, draining, medium type surfacing 1.991 mi. hy. DN-NI-2, SP 56-318, Jefferson Co.; rock asphalt seal surfacing 7.001 mi. Louisville-Bardstown Rd., MP 15-54-B; 108-107-A, Bullitt and Spencer Counties; 5.397 mi. New Castle-Frankfort Rd., SP 52-127, Henry Co.; 5.914 mi. New Castle-Shelbyville Rd., SP 52-137 and SP 52-187, Henry Co.; 9.804 mi. Hodgenville-New Haven Rd., SP 62-1, Larue Co.; 3.541 mi. London-Corbin Rd., SP 63-111, Laurel Co.; 9.697 mi. Providence-Sullivan Rd., SP 117-349 and SP 113-147, Webster and Union Counties; removing, replacing concrete pavement 1,633 sq. yd. Louisville-Cincinnati Rd., MP 56-18-A; 4,428 sq. yd. Louisville-Shelbyville Rd., MP 56-58-A, 8,450 sq. yd. Louisville-Bardstown Rd., MP 56-118-B, all foregoing in Jefferson Co.; 11,980 sq. yd. Louisville-Cincinnati Rd., MP 93-196-A, Oldham Co.; bituminous surfacing 11.308 mi. Maysville-Flemingsburg Rd., SP 81-75, Mason Co.; 3.863 mi. Newport-Maysville Rd., SP 19-31, Campbell Co.; 5.845 mi. Albany-Tennessee state line Rd., SP 27-86, Clinton Co.; 2.01 mi. Fancy Farm-Lowes Rd., SP 42-548, Graves Co.; sidewalk type construction 0.699 mi. Louisville-Shepherdsville Rd., SP 56-138, Jefferson Co.

Minnesota—State Hy. Dpt., St. Paul, bituminous seal coat on 49.73 mi. Group A, Dist. 2; 100.7 mi. Group B, Dist. 4; 55.01 mi. Group C, Dist. 6; 80.64 mi. Group D, Dists. 6 and 8; 5.2 mi. S.P. s761-08, TH 75-6, SN-A-FAP 445 A(4). J. T. Ellison, ch. engr.

Bids Asked

Connecticut—State Hy. Dpt., Hartford, rejected bids June 15 concrete paving, bridge 8,322 ft. hy. Groton. CD 6/18—ENR 6/25, under LB.

Minnesota—State Hy. Dpt., St. Paul, rejected bids June 12, bituminous seal coat surfacing hys., Groups 1, 2, 3, 4, 6 and 7. CD 6/23—ENR 6/25 under LB.

Minnesota—State Hy. Dpt., St. Paul, rejected bids June 12, imprv. 12.8 mi. S.P. 0901-26, Divs. A, B & C, TH 23-185, S.P. 0901-24, TH 23-185, etc. CD 5/26—ENR 5/28.

North Carolina—State Hy. and P. Wks. Comn., Raleigh, W. V. Baise, engr., will not imprv. 4.22 mi. by Proj. 6674, Halifax Co. Project cancelled. CD 2/25—ENR 3/5 under LB.

Oregon — State Hy. Comn., Portland, received no bids June 25, imprv. 3.79 mi. Grant Co. and Buchanan rock production project on Central Oregon Hy., Harney Co. Will readvertise. CD 6/16.

LOW BIDDERS

Arizona—State Hy. Dpt., Phoenix, June 19, imprv. 10.5 mi. Mesa-Florence Junction Hy., Maricopa and Pinal Counties, from N. G. Hill & Co., Rte. 6, Box 551, Phoenix, **$325,706.** CD 6/9—ENR 6/11.

★**California**—State Div. Hys., Sacramento, June 24, imprv. hy. Yolo Co., from Frederickson & Westbrook, 212 13 St., Sacramento, **$548,759***6.9 mi. Yolo Co., from J. A. Casson, 2205 Meekland Ave., Hayward, **$73,500***0.2 mi. Humboldt Co., from Scheumann & Johnson, Box 822, Eureka, **$66,819***5.7 mi. Yolo Co., from Hayward Building Material Co., Atherton and Jackson Sts., Hayward, **$57,070***3.6 mi. Contra Costa Co., from L. J. Immel, Box 65, Sta. A, Berkeley, **$73,947***5 mi. Sacramento Co., from A. Teichert & Son, Inc., P. O. Box 1113, Sacramento, **$18,874***10.9 mi. Placer and Nevada Counties, from W. P. Powell Paving Co., 2133 Riverside Dr., Los Angeles, **$116,521.** Received no bids 6/24 impr. 0.8 Mendocino Co. CD 6/8—ENR 6/11.

Calif., Sacramento—City, June 19, imprv. Muir Way, from McGillivray Constr. Co., P. O. Box 873, Sacramento. **$25,281.** Bids 6/19.

Calif., Stockton—City Council, June 22 imprv. California St. from Harding Way to Miner Ave. and imprv. El Dorado St. from Harding Way to California St., from S. M. McGaw, 425 Lexington Ave., **$25,395.**

D. C., Wash. — District Comrs., District Bldg., June 23, imprv. roadway Overlook Ave. and 4 St. S.W., between South Capital St. and Chesapeake Ave., from Highway Eng. & Constr. Co., 7 and T Sts. N.E. **$101,691,** CD 6/17.

D. C., Wash.—District Comrs., District Bldg., June 22, imprv. roadway, S. Capital St. from Howard Rd. to Nichols Ave., from Wilmoth Paving Co., 1 and P Sts. S.E., **$197,621.** CD 6/19.

D. C., Wash. — District Comrs., District Bldg., June 25, grading streets, roads, alleys, avenues, from W. F. Brenizer Co., 1504 S. Capitol St. **$41,500.** Est. $42,000. CD 6/17.

Idaho—State Dpt. P. Wks., Boise, imprv. 22.917 mi. Old Oregon Trail and 26.27 mi. Raft River Hy., Gooding, Twin Falls and Cassia Counties, from Hoops Constr. Co., Twin Falls, **$56,002;** 7.118 mi. Elmore Co., from Dan J. Cavanaugh, Twin Falls, **$294,801.** Bids 6/2. CD 6/19.

★**Indiana**—State Hy. Comn., Indianapolis, June 25, from McMahan Constr. Co., Rochester, imprv. 4.673 mi. Greene Co., **$287,174;** 4.643 mi. Martin and Davies Counties, **$368,465;** combination bid 4.595 mi. Martin and Davies Counties, **$278,013;** 4.122 mi. Greene Co., **$282,773,** est. $314,570***from Ralph A. Landrey Constr. Co., E. Jackson St., Pike, Muncie, 2.809 mi. Davies and Greene Counties, **$168,125,** est. $187,010; 1.786 mi. Davies and Martin Counties, **$85,389***** from Berns Constr. Co., 129 E. Market St., Indianapolis, 1.003 mi. Marion Co., **$72,830,** est. $74,959***from D. M. Vaughan, 619 S. 10 St., Lafayette, 0.516 mi. Johnson Co., **$43,559,** est. $54,982. CD 6/16—ENR 6/18.

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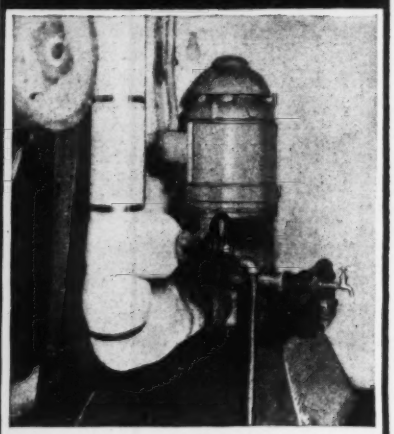

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STREETS, etc. (Low Bidders, Cont'd.)

Md., Baltimore—City, c/o Bd. Awards, City Hall, June 17, imprv. roads, Contr. S.A. 768, from Baltimore Asphalt Block & Tile Co., 1320 N. Monroe St., **$71,217.** CD 6/10.

Minnesota—State Hy. Dpt., St. Paul, June 19, imprv. 10.7 mi. S. P. 3004-19 (Trunk Hy. 107-5) and S. P. 3004-20 (TH 65-5) from Megarry Bros. St. Cloud, **$89,938*****4.3 mi. Nobles Co., from Ulland Bros., Austin, **$48,398.** CD 6/2—ENR 6/4.

★**Missouri**—State Hy. Comn., Jefferson City, June 26, imprv. 2.145 mi. St. Charles Co., from Hannibal Contg. Co., Hannibal, **$186,925** ***2.454 mi. McDonald Co., from E. D. Tyner Constr. Co., Kansas City, Mo., and J. M. Roark, Anderson, **$195,996** ***1.088 mi. and 1.038 mi. Pulaski Co., from Odell & Riney Constr. Co., Hannibal, **$288,583** and **$105,347** respectively. Received no bids June 26, imprv. 2.146 mi. and 2.465 mi. Newton Co. CD 6/16—ENR 6/18.

Nebraska—State Dpt. Roads & Irrigation, Lincoln, June 25, grading, paving culverts, 2 mi. Lancaster Co., from Abel Constr. Co., 900 N. 16 St., and Dobson & Robinson, 823 1st Natl. Bank Bldg., both Lincoln, **$100,534** ***grading and culverts 2.3 mi. Cheyenne Co., from Inland Constr. Co., 3867 Leavenworth St., Omaha, **$44,523.** Received no bids June 25, imprv. 7 mi. Broken Bow-Ansley Rd., 6.9 mi. Berwyn-Mason City Rd., 11.6 mi. Hebron-Geneva Rd., 4.6 mi. Wayne-Pilger Rd., 13.6 mi. Geneva-Hebron Rd., 5.8 mi. Litchfield-Hazard Rd., 10.3 mi. York-Osceola Rd., 8.8 mi. York-Osceola Rd., 7.1 mi. Geneva-Fairmont Rd., 0.7 mi. Geneva-State Girls Training School Rd., 13.5 mi. Superior-Clay Center Rd., 7.6 mi. Lincoln-Beatrice Rd., 5 mi. Milford-Emerald Rd., 2.4 mi. Plattsmouth-Union Rd., 7 mi. Lexington-Elm Creek Rd., 4.6 mi. road from Norfolk north, 3.8 mi. Hannis-Whitman Rd., 12.7 mi. Broadwater-Lisco Rd., 3.9 mi. Brady-Cazad Rd., 7 mi. Beatrice-Virginia Rd., 9 mi. Ainsworth-Long Pine Bassett Rd., 3.3 mi. Omaha-Plattsmouth Rd., 3.2 mi. North Platte-Maxwell Rd., 3 m. Kearney-Odessa Rd., 8.3 mi. Alliance-Hemingford Rd., 3.9 mi. Schuyler-North Bend Rd., 0.6 mi. Union-Nebraska Rd., 2.5 mi. Gretna-Millard Rd., 2.3 mi. Ravenna-Cairo Rd., 1 mi. in Genoa, 8.4 mi. Grand Island-Chapman Rd., 4.9 mi. Ainsworth-Johnstown Rd., 6.2 mi. Brunswick-Niabrara Rd., 4 mi. Omaha-Ralston and Ralston North Rds., 0.5 mi. Cornhusker Rd., Hall Co. Rejected bids June 25, imprv. Patrol 19102, Hebron-Geneva and Patrols 29012 and 29014, York-Osceola, 0.5 mi. Cornhusker Access Rd., Hall Co., 0.3 mi. road from Kimball south, roadside fmprv. 2.3 mi. road DA-WI-2, Cheyenne Co., 2 mi. Lancaster Co. CD 6/17.

North Dakota—State Hy. Dpt., Bismarck, June 19, imprv. 24.6 mi. U.S. Hy. 281, Edgeley southeast, FAP 662 (1) and 150 (2), Dickey and La Moure Counties, from Northern Imprvt. Co., Fargo, **$262,943.**

Oregon—State Hy. Comn., Portland, June 25, imprv. Sect. A, Monmouth-Benton Co. line sect. Pacific Hy., Polk Co., from Edlefsen-Weygandt Co., Box 5626, Portland, **$219,-510;** Sect. B, same road, from McNutt Bros., Genl. Delivery, Eugene, **$278,603.** CD 6/16.

†**South Carolina**—U. S. Eng., Shaw Field, Sumter, June 18, grading, pipelines, structures for drainage, from W. F. Bowe, Jr., Atlanta, Ga.

Texas—State Hy. Dpt., Austin, June 22, concrete paving 3.162 mi. Hy. Spur 126, S.P. 653-1-1, Nederland-Port Arthur Rd. to Port Neches, Jefferson Co., from Russ Mitchell, Inc., 2302 Jefferson St., Houston, **$109,665.**

†**Va., Point Pleasant** — Dpt. Agriculture, Farm Security Admin., 227 E. Edenton St., Raleigh, N. C., June 15, roads, walks, utilities, from Neighbor, Gall & Leach, Inc., Huntington, W. Va. **$127,815.** CD 6/9.

Washington—State Hy. Dpt., Olympia, June 23, imprv. roads, constructing timber bridge 0.9 mi. streets, Renton, King Co., from Northwest Constr. Co., 3950 6 Ave. N.W., Seattle, **$163,945.** CD 6/9—ENR 6/11.

CONTRACTS AWARDED

†**Arkansas**—U. S. Eng., Gay Bldg., Little Rock, streets, roads, to Gregory-Hogan, 115 N. Spring St., Little Rock. Bids 6/15—CD 6/10.

D. C., Wash.—District Comrs., District Bldg., repairing pavements, 1,500 tons asphalt materials and about 3,000 cu. yd. concrete base, to Donaldson Paving Co., Inc., **$135,128.** CD 6/8.

★†**Florida**—U. S. Eng., Courthouse & Postoffice, Jacksonville roads, Inv. 436-42, to Powers & Archibald, Inc., Harvey Bldg., West Palm Beach, less than **$1,000,000.** Awarded 6/19.

Ind., Indianapolis—Bd. P. Wks., L. Brandt, chm., concrete paving Kentuck Ave. from West to Oliver Sts., to R. M. Bowen & Co., 5530 Carrollton Ave., **$33,705.** Est. $40,000. Awarded 6/22. M. G. Johnson, city engr.

Ia., Primghar—Bd. Supervs. O'Brien Co., gravel surfacing 37.75 mi., maintenance gravel surfacing 42 mi., to John Schumacker, Hancroft, **$27,385.** Bids 6/18, awarded 6/18. CD 6/8—ENR 6/11.

Kentucky — Dpt. Hys., Frankfort, [illegible] 2.937 mi. Bell Co., to Nally & Mudd, Springfield, **$439,940.** CD 6/9—ENR 6/11, [illegible] LB.

†**Maryland**—U. S. Eng., 6 and Walnut [illegible] Phila., Pa., grading, topsoil, clearing, to [illegible] Shaull & Son, Mechanicsburg, Pa. **$278,000.**

Minn., Perham—Streets imprvts., sanitary sewers, watermains, curbs, gutters, sidewalks, **WPA, $70,000.** A. M. Stoll, town clk.

†**Mississippi**—U. S. Eng., foot of Prytania St., New Orleans, roads, drainage, etc., to Shuptrine Constr. Co., P. O. Box 1249, Hattiesburg. Awarded 6/22.

Montana—State Hy. Comn., Helena, imprv. 34.8 mi. road to C & F Teaming Co., Inc., and A. La Londe Co., Sidney, **$368,710.** Bids 6/24. CD 6/16.

★†**Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, utilities, coal and storage roads also asphaltic roads, soil base and graveling. Concrete and Materials Co., 405 Granby Bldg., Cedar Rapids, Ia. **$811,846.** Bids 5/9. 5/6—ENR 5/14, under LB.

†**N. J., Eatontown**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., roads, walks sidewalks, service drives. **WPA. $115,-119.** J. H. Weitzen, Chestnut and Hamilton Aves., Trenton, WPA engr.

N. J., Newark—Grading, 5 in. concrete sidewalks. **WPA, $54,000.** G. Andress, City Hall, engr.

N. J., Wanaque—North Jersey Dist. Water Supply Comn., Wanaque, grading, 6 in gravel access patrol roads at reservoir, **WPA, $69,450.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. M., Albuquerque—Clyde Tingley, mayor, paving, curb and gutters, **WPA. $245,373.**

N. M., Albuquerque—C. Tangley, mayor, street imprvs., **WPA. $245,373.**

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, grading, 4 in. macadam and 2 in. asphalt top paving. **WPA. $80,445.** W. W. Johnston, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., New York—President Manhattan Boro, Municipal Bldg., traffic barriers, malls, curbs, sidewalks planting trees. **WPA. $50,810.** W. W. Johnston, 70 Columbus Ave., dir. Div. Operations.

N. Y., St. George (sta. Staten Island)—President Richmond Boro, Boro Hall, restoring pavement over WPA street openings, **WPA, $86,193.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Operations.

★**North Dakota**—State Hy. Dpt., Bismarck, regrading, road imprv. 9.7 mi. U.S. Hy. 10, Richardson, east and west, SN-FAP 2600 (6) Stark Co., to Archie Campbell, Warwick, **$139,879*****bituminous surfacing 9.7 mi. U.S. Hy. 10, Richardton, east and west, SN-FAP 2600(6), Stark Co., to Northern Imprvt. Co., Fargo, **$176,930*****regrading, road imprv. 4.2 mi. U.S. 83, Underwood, east, SN-FAP 62 AB(3), McLean Co., also bituminous surfacing 20.6 mi. U.S. Hy. 83, Underwood, north and east, SN-FAP 336 B(3) and 62 AB(3) McLean Co., to Bismarck Constr. Co., Bismarck, **$62,892** and **$320,986** respectively. Grand total $700,688. Bids 6/19.

★**Ohio**—State Hy. Dpt., Columbus, imprv. 1.051 mi. Summit Co., to Thorpe Constr. Co., N. Union St., Akron, **$411,404,** est. $418,-000***7.249 mi. Butler and Warren Counties to Andrews Asphalt Paving Co., 808 First Natl. Bank Bldg., Hamilton, **$88,435,** est. $92,900*** 2.344 mi. Lake Co., to Cuyahoga Asphalt Paving Co., 13125 Shaker Sq., Cleveland, **$39,486,** est. $30,600***25.38 mi. Allen, Hancock and Putnam Counties and 19.75 mi. Paulding and Putnam Counties, to L. Cossett, 321 W. Front St., Findlay, **$34,406** and **$33,382** respectively, est. $35,380 and $34,400 respectively***38.8 mi. Harding and Wyandot Counties, to U. S. Const. Co., 115 E. Johnson St., Upper Sandusky, **$31,694,** est. $33,689. Grand total $638,807. Bids 6/23. Received no bids June 23 imprv. 4.159 mi. Montgomery Co. CD 6/15—ENR 6/18.

O., Cleveland—Comrs. Cuyahoga Co., resurfacing York Rd., to Allied Corp., Keith Bldg., **$85,469.** Est. $87,000. Bids 6/16. CD 6/10.

Oklahoma—State Hy. Dpt., Oklahoma City, imprv. county road west of Bearden also farm to market road north Cromwell, both Okfuskee Co., to Delta Constr. Co., Kennedy Bldg., Tulsa, **$42,167** and **$31,810** respectively. Est. $54,704 and $31,200 respectively. Bids 6/16 awarded 6/19 and 6/20. CD 6/9.

†**Oklahoma** — U. S. Eng., Citizens Bank Bldg., Denison, Tex., street and road and area paving, Spec. 257-42-211, to Oklahoma Bituminous Distrb. Co., Ada. Approx. **$142,-000.**

★**Oklahoma**—State Hy. Dpt., Oklahoma City, imprv. 7.616 mi. Muskogee Co., to J. W. Moorman & Son, Insurance Bldg., Oklahoma City, **$100,450,** est. $88,500***1.848 mi. Tulsa Co., to Standard Paving Co., 2119 E. 11 St., Tulsa, **$107,740,** est. $157,122***5.11 mi. and 3.783 mi. Rogers Co., to Gaines Bros. Miami, Okla., **$125,950** and **$128,915** respectively, est. $153,102 and $89,460 respectively***5.59 mi. and 3.494 mi. Lincoln Co., to Brooks & Dahlgreen, Insurance Bldg., Oklahoma City, **$205,-553** and **$175,041** respectively, est. $196,385 and $161,748 respectively***4.918 mi. Drum-

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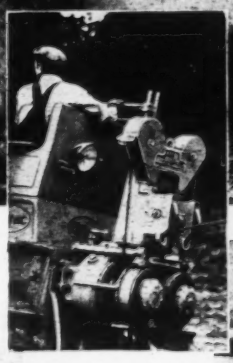

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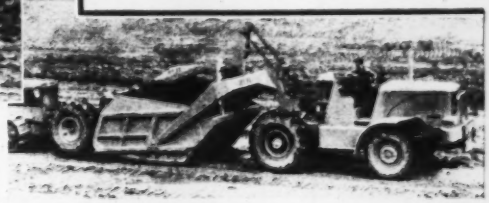
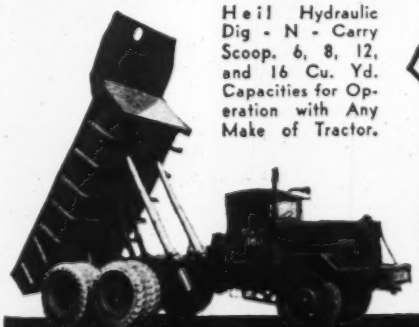


Heil Hi-Speed Tractor-Scoop. 150 H. P. Heil Rubber-Tired Tractor and 15 Cu. Yd. Heil Cable-operated Scoop.



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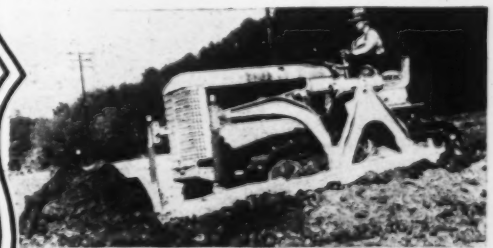

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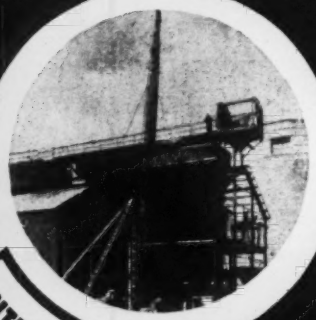

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STREETS, etc. (Contracts Awarded, Cont'd.)

right Co., to Ottinger Bros. Co., Hinton, **$107,352**, est. $74,066. Grand total $1,041,033. Bids 6/16. CD 6/9.

†Oregon—U. S. Forestry Service, Grants Pass, construction, repairs 13 mi. Bear Basin Rd., Gasquet Dist., near here, own forces. **$35,000.** H. C. Obye, superv. Siskiyou Natl. Forest.

Oregon—State Hy. Comn., Portland, imprv. 1.08 mi. Lane Co., to McNutt Bros., Genl. Delivery, Eugene, **$278,603.** Bids 6/25. CD 6/16.

†Tennessee—Tennessee Valley Auth., Knoxville, grading, draining 3 mi. Chestnut Hill-Dandridge Rd. and 0.4 mi. approaches to Swann Bridge over French Broad River, to Codell Constr. Co., Winchester, Ky., **$149,315.** Bids 5/25. CD 5/11—ENR 5/14.

Tenn., Knoxville—Tennessee Valley Auth., Knoxville, grading, bituminous surfacing hys., to R. L. Martin, Nashville, **$285,330.** Bids 6/22. CD 6/2—ENR 6/4.

★**†Texas**—U. S. Eng., Fort Sam Houston, to Colglazier & Hoff, 326 Seguin Rd., San Antonio, asphalt paving roads, concrete sidewalks, Spec. 42-109, **$68,680** est $70,000*** to Engineering Contractors, 1508 Fredericksburg Rd., San Antonio, sanitary sewerage sys., **$36,290**; natural gas distr. lines, facilities, **$27,000**; water distr. sys. and facilities, **$19,600** all foregoing Spec. 42-108. Grand total $151,570. Awarded 6/24.

†Texas—U. S. Eng., Albuquerque, N. M., asphalt paving and drainage, grading to Cage Bros. and J. F. Malcolm, Abilene, **$240,000** and **$175,000** respectively. CD 6/3.

†Texas—U. S. Eng., Fort Sam Houston, reconstructing asphalt roads, **WPA. $208,658.**

†Texas—U. S. Eng., Federal Bldg., Galveston, grading, drainage, asphalt paving, Inv. 359-42-517, to Dodds & Wedegartner, 382 N. Bowie St., San Benito, **$178,000.**

Utah—State Road Comn., Salt Lake City, imprv. 6.791 mi. Millard Co., to J. M. Sumsion, Springville, **$32,620**, est. $31,017. 0.786 mi. Weber and Davis Counties, to Miner Bros., Provo, **$40,558**, est. $34,817. Bids 6/12. CD 6/8.

Wis., Appleton—Outagamie Co., bituminous surfacing 8 mi. State Trunk Hy. 54 between Shocton and New London, own forces. Over **$25,000.**

Wis., Janesville—Rock Co., C. E. Moore, Comr., blacktop surfacing 17 mi. road between Janesville and Evansville, own forces. Over **$25,000.**

Wyoming—Wyoming Hy. Comn., F. Kelso, supt., Cheyenne, imprv. 10.015 mi. Sweetwater Co., to Woodward Constr. Co., Rock Springs, **$121,994**; 12.054 mi. Carbon Co., to C. C. Warrington, Cheyenne, **$128,990.** Bids 6/23. CD 6/16.

N. S., New Glasgow—Miss M. Wadden, town clk., paving, to Warren Bituminous Paving Co., Ltd., 437 Fleet St. W., Toronto, Ont., about **$50,000.** CD 6/16—ENR 6/18.

Quebec—Deputy Minister Dpt. Roads, Quebec City, paving 2.8 mi. Montreal-Ste. Anne De Bellevue Blvd., from Western Ave.-Montreal and St. James St. in Ville St. Pierre, to Charles Duranceau, Ltd., 5847 Hamilton St., Montreal, **$135,000**; paving 2.8 mi. section between Alexandre Taschereau Blvd. and St. Hilaire to Armand Sicotte & Fils, 1906 Van Horne Ave., Montreal, **$150,000.**

Quebec—Dpt. Munitions & Supply, Ottawa, Ont., paving portion roadway between Quebec City and Valcartier, to Prov. of Quebec Dpt. Rds., Govt. Bldgs., Quebec City, Que.

Saskatchewan—Deputy Minister Mackenzie, Dpt. Hys., Regina, reconstructing 35 mi. hy., Hyas, to R. R. Ritchie, Kamsack; 17 mi. hy. Creelman to Thode Bros. Ltd., Dundurn. Bids 6/12. CD 6/5.

EARTHWORK, WATERWAYS

PROPOSED WORK

★**†Calif., Burbank**—City, open storm drain. $715,000. **FWA.** H. I. Stites, city mgr.

Conn., Hartford—Bd. Contr. and Supply, 550 Main St., rein.-con. conduit from Park River and Edwards St. $420,000.

†Maine—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., received no bids June 22, dredging. Over $25,000. CD 6/18.

★**†South Dakota** — Bureau Reclamation, Customhouse, Denver, Colo., plans Deerfield Dam.

Tennessee—State Conservation Comn., State Office Bldg., Nashville, surveys, rebuilding dams destroyed by floods, Whiteville and Carool Lakes.

BIDS ASKED

Bids Asked July 7

†Arkansas—U. S. Eng., P. O. Box 60, Vicksburg, Miss., 132,700 cu. yd. earthwork, east bank Red River, Inv. 1106-42-250.

LOW BIDDERS

★**†California**—U. S. Eng., Wright Sacramento, June 20, levee work levee Tisdale By-Pass, Inv. 85, from Parker, 1112 G. St., Marysville, and Ball Sons, Box 404, Berkeley, **$814,78** 6/8—ENR 6/11.

†California and **Oregon**—Bureau R tion, Klamath Falls, Ore., June 22, ea for construction Line A dike, near Tu Div. Klamath Proj. Oregon-California 1644-D, from Bessonette Bros., Tule **$23,000.** CD 6/2—ENR 6/4.

†N. M., Tucumcari—Bureau Recla Customhouse, Denver, Colo., May 25, cu. yd. earthwork between Station 2 Station 2408, on Conchas Canal, Spec from Utah Constr. Co., 1 Montgomery Francisco, Calif., **$170,940.** CD 5/6—EN

Tex., Aransas Pass — City, J. G. mayor, June 8, seawall imprvs., from Coast Dredging Co., Texas City. $30 CD 5/19—ENR 5/21.

CONTRACTS AWARDED

★**†Arkansas**—U. S. Eng., Box 97, Me Tenn., excavating drainage ditch, Co., Inv. 1092-42-200F, to McWilliams D ing Co., Hibernia Bldg., New Orleans, La. Est. less than **$1,000,000.**

★**†California**—U. S. Eng., 74 New Mont gomery St., San Francisco, earthfill, to Macco Constr. Co., 151 Mission St., San Francisco. Less than **$1,000,000.**

Minn., Fairmont—Martin Co., dredging, drainage work County Ditch 44, Nashville Twp., to Dan Christensen Constr. Co., 1 Ave. S.E., Cedar Rapids, **$45,000.** A. Anderson, Fairmont, engr.

New Jersey—Palisades Park Interstate Comn., 80 Center St., New York, N. Y., reconstructing sea docks with piles, decking, guard rail, etc., Palisade Park, **WPA. $30,587.** CD 6/22—ENR 6/25.

†New Jersey—U. S. Eng., 120 Wall St., New York, N. Y., rehabilitation docks, piling, planking, borrow, etc. **WPA. $72,810.** J. H. Weitzel, Chestnut and Hamilton Aves., Trenton, WPA engr.

Wash., Tacoma—City, 26 115-kv disconnecting switches for second Nisqually Power development, to Railway & Industrial Engineering Co., 166 Jackson St., Seattle, **$33,600.** Bids 6/8. CD 5/19—ENR 5/21.

UNCLASSIFIED

PROPOSED WORK

†California—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, bids soon imprvs. bldgs. Over $150,000.

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†Colo., Trinidad — AIRPORT — City, J. A. Storm, mayor, airport exten., imprvs. $460,000 CAA. CD 4/28—ENR 4/30.

Georgia and Tennessee—REPEATER STATIONS—American Telephone & Telegraph Co., Hurt Bldg., Atlanta, Ga., 6 repeater stations between Atlanta, Ga. and Chattanooga, Tenn.

★**Ill., Chicago**—AIRPORT—Dpt. P. Wks., plans by Burnham & Hammond, 160 N. La Salle St., airport terminal, incl. offices, waiting rooms, auto ramp, passenger and cargo loading piers. $1,800,000. CD 1/6—ENR 1/8.

Ia., Marshalltown—AIRPORT—G. W. Darling, mayor, airport. $100,000. Plans application to FWA.

★**†Kansas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs. Over $3,000,000. Black & Veatch, 4706 Bway., Kansas City, Mo., archts. and engrs. CD 6/4—ENR 6/11.

★**†Kansas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs. Over $3,000,000. Guernsey-Midwest Eng. Corp., and Parr & Aderhold, Drew Bldg., Tulsa, Okla., archts. and engrs.

Kan., Kansas City—PARKING LOTS—H. Payne, city clk., 6 parking lots, asphalt surfacing on concrete slab, grading, etc. $100,000. Truman Schlup, city engr.

Minn., St. Cloud—AIRPORT—A. J. Haberkorn, city clk., surveys exten. airport, imprv. bldgs., runways. R. E. Borrowman, city engr.

†Mississippi—IMPROVEMENTS—U. S. Eng., Postoffice and Courthouse, Vicksburg, imprvs.

Mo., Kirksville—AIRPORT—A. L. Bartlett, mayor, airport imprvs., extens. $100,000. Seeking CAA participation.

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UNCLASSIFIED (Proposed Work, Cont'd.)

★**†New Jersey** — IMPROVEMENTS — U. S. Eng., 6 and Walnut Sts., Phila., Pa., soon lets contract imprvs.; military housing. $810,000.

†New Jersey—RAILROAD—U. S. Eng., 201 Wall St., New York, N. Y., reconstructing 3.5 mi. mainline and 1 mi. sidings, rails, ties, ballasts, etc. and sewers, storm drains, manholes, inlets. $55,733. WPA. J. H. Weitzen, Chestnut and Hamilton Aves., Trenton, WPA engr.

New Jersey—RURAL ELECTRIC SYSTEM—Sussex Rural Electric Cooperative, Sussex, P. Weldie, supt., completing section rural electric sys. Sussex Co. $26,200 REA allot.

†New Mexico—RAILROAD—U. S. Eng., Albuquerque, railroad.

†Oklahoma—IMPROVEMENTS—U. S. Eng., Citizens Bank Bldg., Denison, Tex., imprvs., water distr. lines, facilities, over $15,000; sewers, facilities, over $25,000; natural gas distr. lines, facilities, over $25,000. CD 6/22—ENR 6/25.

†Pennsylvania — IMPROVEMENTS — U. S. Eng., 6 and Walnut Sts., Phila., imprvs.

†Pennsylvania — IMPROVEMENTS — U. S. Eng., 6 and Walnut Sts., Phila., imprvs., military housing.

†Pennsylvania — IMPROVEMENTS — U. S. Eng., 925 New Federal Bldg., Pittsburgh, imprvs. Over $3,000,000. Gannett, Eastman & Fleming, Inc., 600 N. 2 St., Harrisburg, archts. and engrs. **(Correction** — owner's address.) CD 6/25.

★**†South Dakota**—IMPROVEMENTS—U. S. Eng., Administration Bldg., Fort Peck, Mont., imprvs. Over $3,000,000. Hugill & Blatherwick, 367 Boyce Greeley Blk., Sioux Falls, archts. and engrs.

★**†Tennessee**—IMPROVEMENTS—U. S. Eng., 306 U. S. Courthouse, Nashville, imprvs. Over $3,000,000. Walk C. Jones and Walk C. Jones, Jr., Sterick Bldg., Memphis, archts. Allen & Hoshall, 65 McCall Pl., Memphis, engrs. CD 6/2—ENR 6/4.

★**Tenn., Kingsport**—AIRPORT—City, S. L. Cloud, mayor, airport expansion. $500,000.

†Texas—IMPROVEMENTS—U. S. Eng., Federal Bldg., Galveston, received no bids June 11, imprvs., grading, paving, drainage, etc. Inv. 359-42-601. CD 6/8—ENR 6/11.

★**†Texas** — IMPROVEMENTS — U. S. Eng., Cotton Exch. Bldg., Dallas, imprvs., bldgs., etc. $3,000,000.

†Texas—RAILWAY TRACKS, etc.—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., laying 60 mi. railway tracks, dumps, bridging. $100,000. Howard, Needles, Tammen & Bergendorff, 55 Liberty St., New York, N. Y., engrs.

★**†Virginia**—IMPROVEMENTS—U. S. Eng., 415 Post Office & Court House, Norfolk, imprvs.. Over $3,000,000.

†Wash., Ellensburg—AIRPORT APRON—Civil Aeronautics Admin., Boeing Field, Seattle, 200x500 ft. apron, exten. 2 runways, airport.

†Pacific Northwest — DRILLING TEST HOLES—U. S. Eng., Textile Tower, Seattle, Wash., drilling test holes.

BIDS ASKED

Bids Asked July 7

Alta., Ensign—AERODROME—Dpt. Munitions & Supply, Ottawa, Ont., relief intermediate aerodrome serving Vulcan, Alta. S. I. T. School for Dpt. Natl. Defense for air, Ottawa, Ont.

Man., Netley Lake—AERODROME BUILDING—Secy. Dpt. Munitions & Supply, Ottawa, Ont., temporary accommodation, at aerodrome No. Relief for Gimli Service Flying Training School. $150,000. CD 5/27—ENR 6/4.

Bids Asked July 8

★**Que., St. Johns**—HANGARS, etc.—Secy. Dpt. Munitions & Supply, Ottawa, Ont., 3 double and 1 single landplane hangars, No. 9 Air Observers School. $525,000.

Bids Asked July 9

Ill., Chicago — SUBWAY PAINTING — At office P. Harrington, comr. Subways & Superhighways, 20 N. Wacker Dr., painting concrete, masonry, metal and other surfaces in mezzanine stations, on station platforms together with other appurtenant and collateral work, State and Dearborn St. subways, Contr. F-6.

†Oklahoma—IMPROVEMENTS—U. S. Eng., Citizens Bank Bldg., Denison, Tex., imprvs., water distr. lines, facilities, over $15,000; sanitary sewers, facilities, over $25,000; natural gas distr. lines, over $25,000; clearing, grubbing, grading, drainage, etc. over $25,000. CD 6/24—ENR 6/25.

★**†Oklahoma** — IMPROVEMENTS — U. S. Eng., Citizens Bank Bldg., Denison, Tex., imprvs., bldgs. $6,000,000. CD 6/22—ENR 6/25.

Ont., Kingston—TRANSFORMER, etc.—C. C. Folger, city mgr. transformers and switching building, Brock and Macdonnell Sts. $92,000. C. Drever, 81 Brock St., archt.

Bids Asked July 1

†Arkansas — GASOLINE SYSTEMS — U. S. Eng., Gay Bldg., Little Rock, A. [illegible] sys. $100,000.

†Ohio—IMPROVEMENTS—Civil A[illegible] Admin., 222 West North Bank S[illegible] Ill., imprvs., conditioning, grading.

Bids Asked

†Florida—SPUR TRACKS—U. S. En[illegible] house & Postoffice, Jacksonville, spu[illegible] JAX-42-65.

†Florida—CLEARING—U. S. Eng[illegible] house & Postoffice, Jacksonville, clea[illegible] spur tracks, JAX-42-75.

†Florida — IMPROVEMENTS — U. S. Eng[illegible] Courthouse & Postoffice, Jacksonville, [illegible] grading, drainage and paving, JAX-4[illegible]

†Florida — IMPROVEMENTS — U. S. Eng[illegible] Courthouse & Postoffice, Jacksonville, [illegible] water supply sys. and sewage treatment [illegible] JAX-42-94.

†Florida—LIGHTING SYSTEM—U. S. Eng[illegible] Courthouse and Postoffice, Jacksonville, [illegible] ing sys.

†Georgia—IMPROVEMENTS—U. S. Eng[illegible] Courthouse & Postoffice, Jacksonville, Fla[illegible] imprvs., bldgs., JAX-42-69, and JAX-4[illegible]

†Georgia—LIGHTING SYSTEM—U. S. Eng[illegible] Courthouse and Postoffice, Jacksonville, Fla., lighting sys.

†Massachusetts — IMPROVEMENTS — U. S. Eng., 31 St. James Ave., Boston (selected list bidders), imprvs.

LOW BIDDERS

†Illinois — SITE IMPROVEMENTS — Pub. Housing Auth., NHA, 201 N. Wells St., Chicago, June 15, site imprvs., grading, roadways, sidewalks, sewers, water sys., electrical distr., lawns, planting, Ill-11113, from Milburn Bros., Central St., Mount Prospect. **$156,404.** CD 6/11—ENR 5/28, under Roads.

★**†Kansas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg. Tulsa Okla., imprvs., paving, from Shears' Sons, Hutchinson, and C. Holme, Great Bend. Total est. over **$3,000,000.** CD 6/25.

★**†Kansas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs., grading, paving, drainage, clearing, from Kiss Constr. Co., Old Colony Bldg., Des Moines, Ia. ***housing facilities, from J. O. Burgwin Const. Co., Professional Bldg., Pittsburgh, Pa. Est. over **$3,000,000.** Black and Veatch, 4706 Hway., Kansas City, Mo., archts. CD 6/25—ENR 6/11.

★**†Kansas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., June 17 imprvs., housing facilities, from Dennehy Const. Co., 514 W. Noble St., Oklahoma City, Okla. Total est. approx. **$3,000,000.** CD 6/9—ENR 6/11.

†Louisiana—IMPROVEMENTS—U. S. Eng., foot of Prytania St., New Orleans, June 18, imprvs., sewage pump. plant and force mains, Inv. 552, from John M. King, 3535 Plank Rd., Baton Rouge.

†Louisiana—IMPROVEMENTS—U. S. Eng., foot of Prytania St., New Orleans, imprvs., bldgs., roads, fences, utilities, Inv. 587, from Perrilliat-Rickey Constr. Co., S. Rendon and Eve Sts., New Orleans.

★**†New York**—IMPROVEMENTS—Civil Aeronautics Auth., La Guardia Field, Jackson Heights, June 19, imprvs., grubbing and excav., from Frank Stento & Son, Exchange St., Binghamton, **$216,330*****lighting, from Elco Installation Inc., 345 E. 23 St., New York, **$17,473** ***paving roads, etc., from Kellam-Shaffer Co., Maxon Rd., Schenectady, **$304,207.** CD 6/2—ENR 6/4.

★**†New York** — IMPROVEMENTS — U. S. Eng., New York Dist., 120 Wall St., New York, June 16, imprvs., from Delma Eng. Corp. & D'Angelo, 1208 Wyatt St., New York, **(4) $1,845,409*****from Seaboard Constr. Corp., 19 Kisco Ave., Mt. Kisco, **(1) $1,799,560, (2) $1,899,966 (3) $1,799,560. (Correction**—Low bidder). CD 6/17—ENR 6/25 under LB.

Ore., North Bend—RUNWAYS, etc.—State Procurement Office, Weatherly Bldg., Portland, June 23, furnishing, hauling, spreading, compacting and finishing base for apron and taxiways at airport, Proj. 8059, from Coos Bay Dredging Co., Marshfield, **$57,748.**

†Ore., Troutdale—IMPROVEMENTS — Civil Aeronautics Admin., Boeing Field, Seattle, Wash., June 18, imprvs., Proj. 7-247., from Newport Constr. Co., 7031 N.E. Halsey St., Portland. **$197,208.** CD 6/12.

†South Carolina—UTILITIES—U. S. Eng., Fort Jackson, June 25, utilities, from V. B. Higgins Co., Greensboro, N. C. and M. L. Gaines, Columbia.

†Texas—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., from A. J. Rife Constr. Co., 2808 Inwood St., imprvs., water sys., facilities, **$66,600;** sanitary sewerage system facilities, **$136,000;** natural gas distr. lines facilities, **$28,500.** CD 6/3—ENR 6/11.

★**†Texas** — IMPROVEMENTS — Civil Aeronautics Auth., 4th Region, Box 1689, Fort Worth, June 22, imprvs., from C. Hunter Strain, San Angelo. **$652,748.** CD 6/23—ENR 6/25.

UNCLASSIFIED (Low Bidders, Cont'd.)

†**Texas** — IMPROVEMENTS — U. S. Eng., Mac-Gac Bldg., Amarillo, June 22, imprvs., AE-API-16, from Austin Bridge Co., 1813 Clarence St., Dallas, approx. **$1,600,000.** CD 6/18.

†**Texas**—IMPROVEMENTS—U. S. Eng., Fed. Bldg., Galveston, imprvs., street, road and area paving, drainage, from Tom Bland, 2712 E. 22 St., Austin, approx. **$286,000.**

CONTRACTS AWARDED

†**Alabama**—GASOLINE UNLOADING SYSTEM—U. S. Eng., Courthouse, Mobile, gasoline unloading sys., Inv. 569-42-742, to Kenneth Fulgham Co., Thiesen Bldg., Pensacola, Fla. Bids 6/18.

†**Alabama**—IMPROVEMENTS—U. S. Eng., 306 Courthouse, Nashville, Tenn., imprv., temporary bldgs., to Neal C. Morgan Constr. Co., Tuscaloosa. CD 6/19—ENR 6/25.

†**Arizona**—CLEARING, etc.—U. S. Eng., 751 S. Figueroa St., Los Angeles, clearing, grading, fencing bldg. site, to L. N. Tenney, Box 952, Flagstaff.

†**Arizona**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles., Imprvs., No. 581, to J. S. Sundt, 440 S. Park Ave., Tucson. Est. over **$40,030.**

★†**Arizona**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., imprvs., to Murphey-Keith Bldg. Co., Box 2267, Tucson, approx. **$3,000,000.** Awarded 6/22.

†**Arizona** — IMPROVEMENTS — U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., imprvs., to United Concrete Pipe Corp., and Arizona Rock & Sand Co., P. O. Box 1, Sta. H, Los Angeles. Est. over **$25,000.** Awarded 6/19.

★†**Arizona**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., to Tanner Constr. Co., Box 1832, Phoenix, Ariz. Est. less than **$1,000,000.** CD 6/17—ENR 6/18.

†**Arizona**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., sewer, water, gas sys., streets, Inv. 512, to M. M. Sundt Constr. Co. and White Constr. Co., 440 S. Park Ave., Tucson. Est. over **$25,000.** Bids 6/8.

★†**Ariz., Tucson**—IMPROVEMENTS — Ryan School of Aeronautics, Lindbergh Field, 2930 Pacific Hy., San Diego, Calif., imprvs., bldgs., to Olmstead Building Co., 3878 40 St., San Diego, Calif. Est. **$600,000.** F. Hope, Jr., 1008 San Diego Trust & Savings Bldg., San Diego, Calif., archt. CD 6/15—ENR 6/18.

†**Arkansas**—IMPROVEMENTS—U. S. Eng., Gay Bldg., Little Rock, imprvs., sewage disposal plant, incinerator, to Edward H. Meyer Cons. Co., Oshkosh, Wis. Bids 6/19. CD 6/10.

†**Arkansas**—IMPROVEMENTS—U. S. Eng., Gay Bldg., Little Rock, grading, imprvs., to Gregory-Hogan, 115 N. Spring St., Little Rock. Bids 6/29—CD 6/10—ENR 6/18.

†**Arkansas**—ELECTRICAL DISTRIBUTION SYSTEM—U. S. Eng., Gay Bldg., Little Rock, electrical distr. sys., to Harvill-Byrd Electric Co., 721 Main St., Little Rock. Bids 6/18. CD 6/10.

★†**Arkansas** — ELECTRICAL DISTRIBUTION SYSTEM—U. S. Eng., P. O. Box 97, Memphis, Tenn., electrical distr. sys. and primary switch station, Inv. 1092-42-206F, to Guy Townsend Co., Jackson, Tenn. Est. less than **$1,000,000.**

†**Arkansas**—FENCES—U. S. Eng., Gay Bldg., Little Rock, fencing, to Chain-Link Fence Corp., 1629 W. 31 St., Chicago, Ill. Bids 6/25. CD 6/10—ENR 6/18.

★†**Arkansas**—RAILROAD—U. S. Eng., Box 97, Memphis, Tenn., railroad, to St. Louis-San Francisco Railway Co., 906 Olive St., St. Louis, Mo. Est. less than **$1,000,000.**

★†**Arkansas**—IMPROVEMENTS—U. S. Eng., P. O. Box 97, Memphis, Tenn., imprvs., to Forcum-James Co., Dyersburg, Tenn., over **$3,000,000.** Havens and Emerson, Leader Bldg., Cleveland, O., archts and engrs. CD 6/23—ENR 6/25, under CA.

†**Arkansas** — RAILROAD — U. S. Eng., Gay Bldg., Little Rock, railroad, to Chicago, Rock Island & Pacific Ry. Co., 6 LaSalle St. Station, Chicago, Ill. Awarded 6/22. CD 6/10—ENR 6/18, under LB.

★†**California**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., to Macco Constr. Co., 151 Mission St., San Francisco. Less than **$1,000,000.** Bids 6/19.

†**California**—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., No. 549, to Oswald Bros., 366 E. 58 St., Los Angeles. Est. over **$25,000.** Bids 6/19, awarded 6/20.

★†**California**—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, imprvs., temporary military housing, to Moore and Roberts, 693 Mission St., San Francisco.

★†**California**—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, imprvs., temporary military housing, to F. C. Stolte Co., 1405 San Antonio Ave., Alameda. Additional to CD 6/4—ENR 6/11, under CA.

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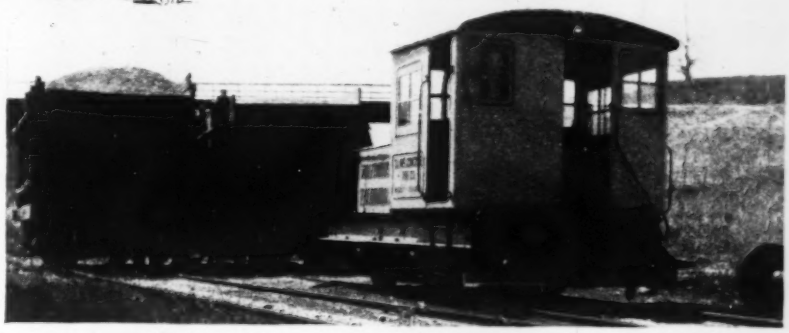

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★**†California**—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, imprvs., temporary military housing, to L. H. Hansen & Sons, 313 Palm Ave., Fresno.

★**†California**—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, imprvs., temporary military housing, to Standard Bldg. Co., 1500 Judah St., San Francisco.

★**†California**—IMPROVEMENTS—U. S. Eng., Wright Bldg., Sacramento, imprvs., temporary military housing, to Guy E. Hall, 1326 30 St., Bakersfield.

★**†California** — IMPROVEMENTS — Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. facilities, NOY 5440, to Macco Constr. Co., 815 Paramount Blvd., Clearwater. **$1,498,000.**

†California—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., to R. W. Hampton, 4031 Goodwin Ave., Los Angeles. Est. over **$25,000.** Awarded 6/22.

†California—IMPROVEMENTS—U. S. Eng., 751 S. Figueroa St., Los Angeles, imprvs., No. 548, to R. A. Conyes & R. O. Dixson, 3901 Medford St., Los Angeles. Bids 6/22, awarded 6/23. CD 6/16.

†Colorado — ELECTRICAL DISTRIBUTION SYSTEM—U. S. Eng., c/o Postmaster, Denver, electrical distr. sys., to R. N. Campsey, Colorado Springs.

★**†Colorado**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., to Peter Kiewit Sons Co., Omaha Natl. Bank Bldg., Omaha, Neb., G. W. Condon Co., Grain Exchange Bldg., Omaha, Neb., and E. H. Honnen, Colorado Springs. CD 6/18—ENR 6/25.

★**†Colorado**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., to Peter Kiewit Sons Co., Omaha Natl. Bank Bldg., Omaha, Neb. Est. over **$3,000,000.** CD 5/26—ENR 5/28.

†Delaware—IMPROVEMENTS—U. S. Eng., 6 and Walnut Sts., Phila., Pa., imprvs., drainage, paving, to Standard Bitulithic Co., 50 Church St., New York, N. Y. **$384,000.**

★**†Florida**—IMPROVEMENTS—U. S. Eng., Courthouse and Postoffice, Jacksonville, imprvs., Inv. 436-42, to W. L. Cobb Const. Co., 1102 22 St., Tampa, less than **$1,000,000.** Awarded 6/24.

★**†Florida**—IMPROVEMENTS—U. S. Eng., Courthouse and Postoffice, Jacksonville, imprvs., Inv. 436-42, to Ryan Constr. Co., Stovall Office Bldg., Tampa, less than **$1,000,000.** Awarded 6/20.

★**†Florida**—IMPROVEMENTS—U. S. Eng., Courthouse and Postoffice, Jacksonville, imprvs., bldgs., Inv. 436-42, to J. L. Ewell, Lakeland, approx. **$600,000.** Awarded 6/20.

★**†Florida**—IMPROVEMENTS — U. S. Eng., Courthouse & Postoffice, imprvs., Inv. 436-42, to Faulk & Coleman, Tampa, and to Cone & Manley, Tampa, less than **$1,000,000.** Awarded 6/20.

★**†Georgia**—IMPROVEMENTS—U. S. Eng., Courthouse & Postoffice, Jacksonville, imprvs., Inv. 436-42, to Wainer Const. Co., Valdosta, and Coffee Const. Co., Valdosta, less than **$1,000,000.** Awarded 6/24.

★**†Georgia**—IMPROVEMENTS—U. S. Eng., Postoffice Bldg., Savannah, imprvs., to C. M. Guest & Sons, Anderson, S. C. **$578,110.**

†Idaho — IMPROVEMENTS — U. S. Eng., Pittock Blk., Portland, Ore., imprvs., bldgs., Inv. 698-19, to Morrison-Knudsen Co., 319 Bway, Boise. Bids 6/10.

†Illinois—IMPROVEMENTS—U. S. Eng., 520 Merchandise Mart, Chicago, imprvs., to I. D. Lain, Sangamon Ave., Springfield, Watseka Constr. Co., Springfield, and Rock Road Constr. Co., 5915 N. Rogers St., Chicago. Est. **$250,000.**

★**†Illinois** — IMPROVEMENTS — U. S. Eng., 520 Merchandise Mart, Chicago, architectural, construction and management services, imprvs., to Austin Co., 16112 Euclid St., Cleveland, O. Over **$3,000,000.** CD 6/9—ENR 6/11.

★**†Kansas**—IMPROVEMENTS — U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs., sewer and water lines, to Asplund Constr. Co., Enid, Okla. Entire project over **$1,000,000.**

★**†Kansas**—IMPROVEMENTS — U. S. Eng., Wright Bldg., Tulsa, Okla., imprvs., paving, etc., to Shears Sons, Hutchinson, and C. Hulme, Great Bend; grading, to Geiger & Rutherford, Leavenworth, and D. G. Hansen, Logan.

†Kansas—ELECTRIC WIRING, etc.—U. S. Eng., 1709 Jackson Sts. Omaha, Neb., electric wiring, water sys., sewers, to J. L. Clark & Sons, Leavenworth.

★**†Kansas**—IMPROVEMENTS — U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs., bldgs., to Price, Nicholson & Boyinton, 605½ W. Main St., Oklahoma City, Okla.; paving, to Harrison Eng. Co., Fairfax Bldg., Kansas City, Mo., Freeto Constr. Co., Pittsburg, and Kaw Paving Co., Crane and Topeka Sts., Topeka. Total est. over **$1,000,000.**

†Louisiana—IMPROVEMENTS—U. S. Eng., foot of Prytania St., New Orleans, imprvs., to R. B. Tyler Co. and E. A. Caldwell, Box 392, Lafayette. Awarded 6/20.

†Maine—DOCKS—Government Agency to South Portland Shipbuilding Co., St., South Portland. Est. **$175,900.**

Maryland — IMPROVEMENTS — In Company, imprvs., bldg., to Consolida gineering Co., 20 E. Franklin St. **$60**

†Massachusetts — IMPROVEMENTS Eng., Park Square Bldg., Boston, imp Daniel O'Connell's Sons, Inc., 480 H St., Holyoke.

†New Jersey — IMPROVEMENTS — Eng., 6 and Walnut Sts., Phila., Pa., to C. T. Burket, Vineland.

Mass., Everett (br. Boston)—COAL INAL—Eastern Gas & Fuel Asso., St., coal terminal exten., trestle a storage facilities, to Bond Bros., 77 Fe

★**†Nebraska**—IMPROVEMENTS—U. S 1709 Jackson St., Omaha, imprvs., pipelines, sewers, watermains, railroad to Empire Const. Co., 901 S. 40 St., grading, to J. A. Terteling & Sons, Idaho. Total Project **$3,000,000.** CD ENR 6/4.

†New Jersey — IMPROVEMENTS — trial Company, imprvs., to A. M. Hazel 117 Liberty St., New York. **$250,000.** Harris, Inc., 27 William St., New York.

N. J., Jersey City—PIER BUILDINGS R.R., J. W. Smith, ch. engr., Midland Cleveland, O., pump house, paint shop, penter shop, boiler house, office bldg., story, brick, to James Mitchell, Inc., 575 Side Ave. Bids 6/1. CD 5/28.

★**†New Mexico** — IMPROVEMENTS — Eng., Albuquerque, imprvs., bldgs. Parks, Marshall & McCleskey, Constr. Dallas, Tex. Approx. **$4,600,000.** CD ENR 4/16.

†New Mexico—UTILITIES—U. S. Albuquerque, utilities, Inv. W-911-42-15 J. H. Ryan and E. M. Silver, Albuquer CD 6/3.

N. Y., Brooklyn—CAR TRACK REMOVAL etc.—President Brooklyn Boro, Boro Hall removing car tracks and restoring pavement **WPA. $240,020.** W. W. Johnston, 70 Columbus Ave., New York, Dir Div. Operations.

★**†North Carolina** — HYDRO ELECTRIC PLANT and DAM—Federal Works Agency IS and F Sts. N.W., Wash., D. C., dam and hydro electric plant, Yadkin River Project, own forces. Est. **$8,000,000.** W. R. Holway & Associates, 302 E. 18 St., Tulsa, Okla., engrs. K. Markwell, proj. engr. CD 4/11/39 —ENR 4/13/39, under CA.

★**†North Carolina** — IMPROVEMENTS — U. S. Eng., Maxton, imprvs., to V. P. Loftis Co., Builders Bldg., Charlotte. Over **$500,000.** Total est. $3,000,000 to $5,000,000. Bids 6/15. CD 6/19—ENR 6/25, under LB.

★**†Oklahoma**—IMPROVEMENTS—U. S. Eng., Citizens Natl. Bank Bldg., Denison, Tex., imprvs., bldgs., etc., to Younger Engineering Co., 1225 Milam Bldg., San Antonio, Tex. **$340,000.** Total est. $5,500,000. CD 5/12—ENR 5/14.

★**†Oklahoma**—IMPROVEMENTS—U. S. Eng., Citizens Bank Bldg., Denison, Tex., imprvs., military housing, to Vilbig Constr. Co., Paris and Bourbon Sts., Dallas, Tex., approx. **$3,600,000.** CD 6/15—ENR 6/18.

†Oklahoma—IMPROVEMENTS—U. S. Eng., Citizens Bank Bldg., Denison, Tex., imprvs., bldgs., to Younger Engineering Co., 1225 Milam Bldg., San Antonio, Tex. **$224,000.** CD 6/15—ENR 6/18.

★**†Oregon** — IMPROVEMENTS — Industrial Company, improvements, to Crandall Engineering Co., 261 Franklin St., Boston, Mass. **$1,700,000** Federally financed.

†Oregon — IMPROVEMENTS — Industrial Company, imprvs., to Gilpin Constr. Co., 5500 N. Front Ave., Portland, **$284,000** Federally financed.

★**†Oregon** — IMPROVEMENTS — Industrial Company, imprvs., to Puget Sound Bridge & Dredging Co., 2929 16 Ave. S.W., Seattle, Wash., **$3,000,000.** Federally financed.

†Oregon — IMPROVEMENTS — U. S. Eng., Pittock Blk., Portland, imprvs., bldgs., to Tri-State Constr. Co., 1812 N.E. 40 St., Portland. **$380,000.** Awarded 6/20.

†Pennsylvania — IMPROVEMENTS — U. S. Eng., 6 and Walnut Sts., Phila., imprvs., to Union Paving Co., Broad and Stiles Sts., Phila. **$150,000.**

★**†Pennsylvania** — IMPROVEMENTS — U. S. Eng., 6 and Walnut Sts., Phila., imprvs., to C. T. Burket, Vineland, N. J. Est. **$500,000.** Bids 5/23. CD 5/19.

Pennsylvania—MINE SHAFT—H. C. Frick Coal & Coke Co., G. W. Brown, genl. purch. agt., Carnegie Bldg., Pittsburgh, mine shaft, off Route 88, Ronco Mine, Green Co., to R. G. Johnson, Washington Trust Bldg., Washington.

†Rhode Island — UTILITIES — U. S. Eng., 819 Industrial Trust Bldg., Providence, utilities, to G. Duteau, 90 Cloran St., Springfield, Mass. Est. over **$25,000.**

★**†South Carolina**—IMPROVEMENTS—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash. D. C., Supplemental Agreement 2, addnl. facilities, NOY 4413, to Daniel Constr. Co., Anderson, **$3,777,786.**

†South Dakota—ELECTRICAL WORKS—U. S. Eng., 1709 Jackson St., Omaha, Neb., electrical work, to Hub Electric Co., 217 W. 4 St., Waterloo, Ia. **$55,098.**

UNCLASSIFIED (Contracts Awarded, Cont'd.)

★**†Tennessee**—IMPROVEMENTS—U. S. Eng., P. O. Box 97, Memphis, imprvs., grading, to Ziegler Constr. Co., American Natl. Bank Bldg., Nashville. Under **$1,000,000.** CAA.

★**†Tennessee**—IMPROVEMENTS — Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional facilities, Supplemental Agreement 1, NOY 5484, to Dunn Constr. Co., Inc., and Polk-Smartt Paving Co., Chamber of Commerce Bldg., Birmingham, Ala. **$9,922,500.** Awarded 5/19. Additional to CD 5/25—ENR 5/25, under CA.

†Texas—CLEARING, etc.—U. S. Eng., Federal Bldg., Galveston, clearing, grubbing, Inv. 258-42-182, to McGough Bros., Bankers Mortgage Bldg., Houston. Approx. **$66,000.** Awarded 6/21.

★**†Texas** — IMPROVEMENTS — U. S. Eng., Albuquerque, N. M., imprvs., military housing, Inv. 257-42-182, to Lee Moor Contg. Co., Bassett Tower, El Paso. **$680,000.**

★**†Texas** — IMPROVEMENTS — Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional facilities, Supplemental Agreement 4, NOY 4090, to Brown & Root, W. S. Bellows and Columbia Constr. Co., P. O. Box 866, Corpus Christi, **$6,722,215.** Awarded 6/11. Additional to CD 4/24—ENR 4/30, under CA.

★**†Texas** — IMPROVEMENTS — U. S. Eng., Albuquerque, N. M., to Uvalde Const. Co., Santa Fe Bldg., Dallas, imprvs., paving, asphalt topping, rock base, Inv. 257-42-183, **$170,000;** grading, excav., Inv. 257-42-182, **$78,000;** sewage disposal plant, incinerator, Inv. 257-42-182, **$120,000;** water distr. lines, facilities, Inv. 257-42-182, **$86,400***** to Callaghan Const. Co., 1109 E. Missiouri St., El Paso, electric distr. sys., Inv. 257-42-182, **$38,200.** Grand total $492,600.

★**†Texas**—IMPROVEMENTS—U. S. Eng., Albuquerque, N. M., construction and architectural-engineering services, imprvs., to McMillan, Glover & McCullough, Lubbock, over **$3,000,000.** Bids 6/23. CD 6/16—ENR 5/19.

★**†Texas**—IMPROVEMENTS—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., imprvs., to A. J. Rife Constr. Co. & Associates, 2808 Inwood St., Dallas, over **$3,000,000.** CD 6/3—ENR 6/11.

†Texas — IMPROVEMENTS — U. S. Eng., Albuquerque, N. M., to B & M Constr. Corp., Petroleum Bldg., Oklahoma City, Okla., imprvs., natural gas lines, **$28,360;** sanitary sewer lines, facilities, **$168,000;** water distr. lines, facilities, **$54,400.** Grand total $250,760. CD 6/8—ENR 6/25.

★**†Texas** — IMPROVEMENTS — U. S. Eng., Citizens Bank Bldg., Denison, Contr. 1, imprvs., to Younger Engineering Co., 1225 Milam Bldg., San Antonio, approx. **$245,000.** Total est. $5,500,000. CD 5/28—ENR 6/4.

†Texas—IMPROVEMENTS—U. S. Eng., Fort Sam Houston, miscellaneous facilities, to Williams & Whittle & Williams & Broughton, 5422 Mockingbird Lane, Dallas, **$175,000.** Awarded 6/22.

★**†Virginia**—SITE IMPROVEMENTS—Public Housing Auth., NHA, Temporary Bldg. 2, 19 and D Sts. N.W., Wash., D. C., site imprvs., grading, sewers, water and electrical distr. sys., landscaping or demountable housing, Project VA 44-067, to Virginia Engineering Co., Newport News, **$3,500,000.** Bids 5/13. CD 5/11.

★**†Wyoming**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., bldgs., etc., to Paachen-Klewit Co., Cheyenne ***bldg., utilities, to J. Webber, Cheyenne*** bldgs., to J. Howard, Cheyenne.

★**†Wyoming**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., bldgs., to Morrison-Knudsen Co., Inc., 319 Bway, Boise, Idaho. Bids 5/27; power distr. sys., to Cazin & Houtz, Evanston, Bids 5/20.

†Wyoming—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, Neb., imprvs., to S. H. Reid Co. and A. C. Smith, both Laramie. CD 5/26—ENR 5/28.

★**†Outside United States**—IMPROVEMENTS—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional facilities, Supplemental Agreement 2, NOY 4162, to Frederick Snare Corp., 114 Liberty St., New York, N. Y. **$2,756,000.** Awarded 6/8. Additional to CD 10/29, under CA.

B. C., Vancouver—HANGARS—Dpt. Natl. Defense for Air, Ottawa, Ont., steel hangars, Jericho Beach R.C.A.F. base, to Canadian Bridge Co., Ltd., 1219 Walker Rd., Walkerville, Ont. **$83,000.**

N. B., Scoudouc — AERODROME — Dpt. Transport, Ottawa, Ont., addn. development aerodrome, to Dexter Constr. Co., Ltd., Dorchester Crossing, about **$42,300.**

N. S., Dartmouth—AIRPORT—Dpt. Transport, Ottawa, Ont., addnl. imprvs. to R.C.A.F. Airport, to Acadia Constr. Co., Ltd., Halifax, about **$260,000.**

N. S., Dartmouth — HANGAR — Dpt. Natl. Defense for Air, Ottawa, Ont., hangar, R.C.A.F. Station, to Dominion Bridge Co., Ltd., 1st Ave., Lachmie, Que. **$68,000.**

N. S., Dartmouth—RECEIVING STATION—Dpt. Natl. Defense for Air, Ottawa, Ont., receiving station Albro Lake, to Fundy Constr. Co., Ltd., Russell and Glesville St., Halifax, **$120,000.**

Ont., Mountainview (Hamilton)—AERODROME—Dpt. Transport, Ottawa, addnl. de-

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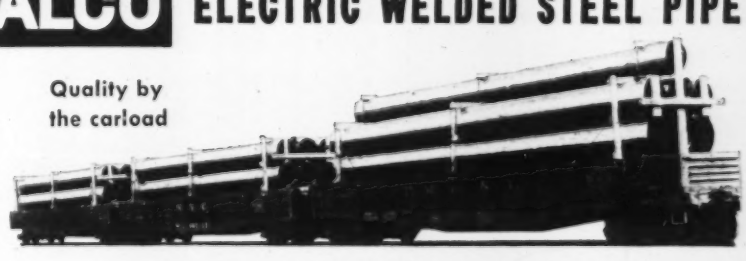

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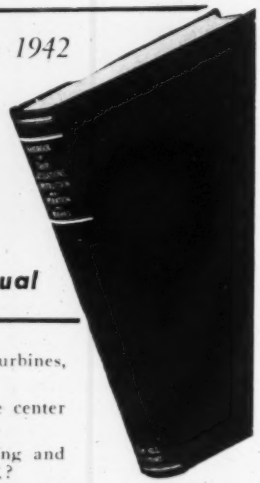

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PUBLIC BUILDINGS

PROPOSED WORK

†**Ala., Decatur** — Tennessee V... Knoxville, Tenn., freight termina... nessee River, south bank Wheeler ... $140,000.

†**Ala., Guntersville**—Tennessee V... Knoxville, Tenn., freight termina... nessee River, south bank Gunters... voir, Scott St. $105,000.

†**Ala., Mobile**—City, Bd. Educ., ... 5/28, Anne St. School, Ala. 1-146. FWA 6/1—ENR 6/4, under LB.

†**Arkansas**—U. S. Eng., 300 Broa... Rock, housing.

Ark., Bauxite—Bauxite School Bd., ... school addn. $150,000. Seeking federal ...

★†**California**—Alameda Housing Auth., ... Second St., Alameda, demountable ... for NHA.

★†**California**—Alameda Housing Auth., ... Second St., Alameda, sketches by K... Hass, 525 Market St., San Francisco, ... housing units, Woodstock Housing P... for NHA.

†**Fla., Valparlso**—U. S. Eng., Courthou... Mobile, received no bids June 20, laborato... Inv. 569-42-751. Will readvertise.

★†**Indiana**—Pub. Housing Auth., NHA, ... N. Wells St., Chicago, Ill., bids in abo... 3 weeks, administration and commer... bldgs.; bids later housing units. A. ... Strauss, 415 Cal-Wayne Bldg., Fort Wayn... archt. CD 5/28—ENR 6/4.

★†**Indiana**—U. S. Eng., 520 Merchand... Mart, Chicago, Ill., plant. Over $2,000,0...

†**Louisiana**—Pub. Housing Auth., NHA, Elec... tric Bldg., Forth Worth, Tex., plans by S. ... Weiner, Commercial Natl. Bank Bldg., Shreve... port, housing. $400,000.

†**Md., Glen Burnie**—Fed. Works Agency, ... St. between 18 and 19 Sts. N.W., Wash., D. ... plans by Brucker & Fenhagen, 325 N. Charl... St., Baltimore, shop bldg.

Mich., Saginaw—Saginaw General Hosp... 1447 N. Harrison St., plans by Schmidt, Ga... den & Erikson, 104 S. Michigan Ave., Chica... Ill., 3 story, brick, concrete steel hosp... addn. $275,000.

†**Mo., Berkeley**—Berkeley School Dist... St. Louis Co., G. A. Pfitzinger, pres. Bd. ... Educ., bids soon high school addn., Carol... Ave. $14,400. **FWA.** CD 5/4—ENR 5/7.

★†**Ohio** — Cleveland Metropolitan Housing ... Auth., E. J. Bohn, secy., West Mall Dr., ... Cleveland, rejected bids Bedford Garden... Housing, Project OHIO 33073, and Riverside ... Park Housing, OHIO 33076, for NHA. CD ... 5/20—ENR 5/28, under LB.

Ore., The Dalles—Port of The Dalles, ... within 30 days, 500,000 bu. grain elevat... $150,000.

★†**Pennsylvania**—Veterans Admin., Vermont ... Ave. between H and I Sts. N.W., Wash., ... D. C., building. $2,000,000.

★†**Pennsylvania**—U. S. Eng., Federal Bldg., ... Pittsburgh, military housing. Over $2,000,000.

Pa., Phila.—Philadelphia State Hospital, ... Byberry, Phila., plans by G. Wharton Pepper ... Jr., 1600 Walnut St., hospital addn. over ... $150,000.

Tenn., Chattanooga—Chattanooga Housing ... Auth., Chattanooga, 200 homes. $150,000. Seek... ing federal aid.

†**Tenn., Chattanooga** — Tennessee Valley ... Auth., Knoxville, freight terminal on Ten... nessee River. $175,000 incl. land.

†**Texas**—U. S. Eng., Federal Bldg., Galves... ton, bids soon, Project 4, bldgs. $275,000.

†**Texas**—U. S. Eng., Federal Bldg., Galves... ton, plans by C. H. Page & Son, Gracy-Enfield ... Bldg., Austin, bldg. $500,000.

†**Texas**—U. S. Eng., Fort Sam Houston, bids ... soon, shop, etc. Spec. 42-138. $45,000.

Tex., Beaumont—South Park Ind. School ... Dist., c/o C. G. Johnson, plans by Steinman ... & Colemon, Box 3267, and bids soon 2 story, ... part bsmnt., 160x465 ft., brick, cut stone ... rein.-con. addn. to McArthur Junior High ... School, Tex. 41-326. $243,019. Applied for ... FWA funds.

Tex., Bishop—Bishop Independent School ... Dist., voted bonds, school, $150,000 or more. ... CD 6/22.

Tex., College Station—A. & M. College, Col... lege Station, received no bids June 3, power ... plant unit. $75,000. CD 5/28.

†**Utah**—U. S. Eng., 32 Exchange Pl., Salt ... Lake City, housing.

PUBLIC BLDGS. (Proposed Work, Cont'd.)

★**Utah**, **Ogden** — Weber Co., c/o County Clerk, plans by S. E. Shreeve, Keisel Bldg., hospital bldgs. $1,500,000. Plans application to FWA. CD 3/27—ENR 4/2.

★**†Wisconsin**—U. S. Eng., 408 Federal Bldg., Milwaukee, plans by Smith-Hinchman & Grylls, Inc., archts. and engrs., 800 Marquette Bldg., Detroit, Mich., plant. Over $3,000,000.

★**†Pacific Northwest**—Dpt. Interior, Interior Bldg., 19 and C Sts. N.W., Wash., D. C., bldg. $500,000.

†Pacific Northwest — U. S. Eng., Textile Tower, Seattle, Wash., bldgs., etc.

BIDS ASKED

Bids Asked July 8

★**†Maryland**—Baltimore Housing Auth., 709 E. Eager St., Baltimore, housing, Project Md. 2-10, for NHA. $2,000,000. Extended date. CD 6/2—ENR 6/4.

Bids Asked July 9

★**†Pennsylvania**—Beaver County Housing Auth., Monaca, housing Projects 36302 and 36301, for NHA. Extended date. CD 6/24—ENR 6/4.

★**†Wash., Bremerton** — School Dist. 100-C, high school. $1,000,000. Extended date. FWA. Naramore & Brady, Dexter Horton Bldg., Seattle, archts. CD 6/10—ENR 6/18.

Bids Asked July 14

★**†Arkansas**—U. S. Eng., Gay Bldg., Little Rock, bldgs. $2,200,000. CD 5/18—ENR 5/21.

Bids Asked August 3

†Pennsylvania—Pub. Housing Auth., NHA, 270 Bway., New York, N. Y., demountable housing, Project Pa. 36292. Extended date. CD 6/8—ENR 6/11.

Bids Asked

†Kansas — U. S. Eng., Ft. Leavenworth, bldgs., facilities.

†Missouri—U. S. Eng., Ft. Leonard Wood, bldgs., utilities.

†Texas—U. S. Eng., Fort Sam Houston, bldgs., Spec. 42-150.

†Texas — U. S. Eng., Fort Sam Houston, bldgs., Spec. 42-157.

†Texas — U. S. Eng., Fort Sam Houston, bldgs., Spec. 42-162.

†Texas — U. S. Eng., Fort Sam Houston, bldgs., Spec. 42-165.

★**†Texas**—U. S. Eng., Fort Sam Houston, military housing; underground utilities. Spec. 42-156.

LOW BIDDERS

★**†Louisiana**—Housing Auth. of New Orleans, American Bank Bldg., New Orleans, June 24, housing, Project La. 1-4, for NHA, from R. P. Farnsworth & Co., Inc., 1515 S. Salcedo St., New Orleans. **$2,377,524.** H. A. Benson, G. A. Christy and W. E. Spink, Carondelet Bldg., New Orleans, archts. CD 6/4—ENR 6/11.

†Maryland—Farm Security Admin., Upper Darby, Pa., dormitory and maintenance bldg., from Frank H. Wilson, Ardmore, Pa. **$155,653.** CD 6/17.

†Maryland—Farm Security Admin., Upper Darby, Pa., trailer camp, utilities, from Mahoney Bros., Knickerbocker Bldg., Baltimore. **$29,917.**

†Maryland—War Dpt., 18 St. and Constitution Ave. N.W., military housing, from Chas. R. Scrivener Co., 606 Charing Cross Rd., Baltimore.

†Maryland—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., military housing, from Leimback & Williams, 30 W. Biddle St., Baltimore.

★**†Massachusetts** — Chicopee Housing Auth., 40 Center St., Chicopee, June 24, housing, Project Mass. 8-1, for NHA, from M. Sunelli & Sons, Inc., 38 Chauncy St., Boston, **$983,000.** CD 6/19—ENR 6/11.

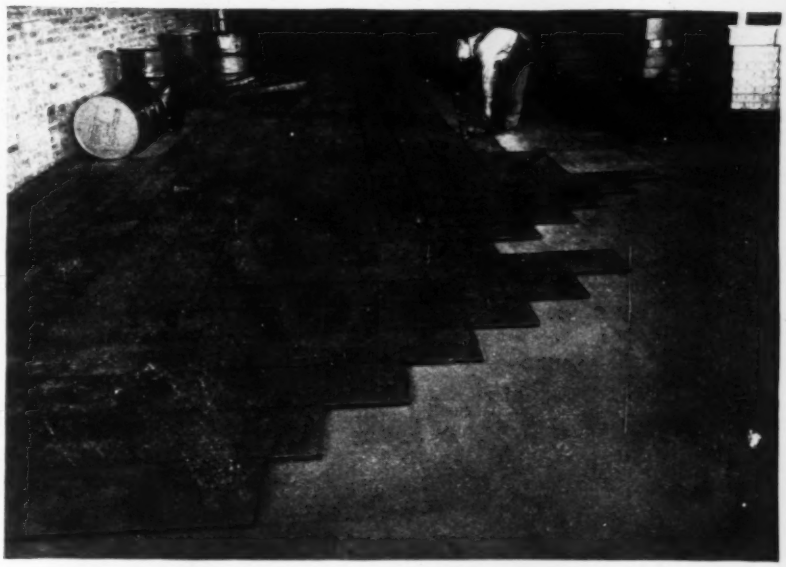
†Nevada—Pub. Housing Auth., NHA, Humboldt Bank Bldg., 785 Market St., San Francisco Calif., June 22, demountable houses, NEV 26041, and 25 demountable houses NEV 26031, from Hayward Constr. Co., Hayward, Calif. Proposals, **(A) $389,477 (B) $336,382 (C) $33,095** Delongchamps and O'Brien, Gazette Bldg., Reno, archts. CD 5/5—ENR 5/7.

†Nevada—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., temporary military housing expansion, from Myers Bros., 3407 San Francisco Rd., Los Angeles, Calif.

★**†Pennsylvania**—Pub. Housing Auth., NHA, 270 Bway., New York, N. Y., June 23, housing, Project Pa. 36293, from Rathgeb-Walsh, Inc., 184 N. Main St., Portchester, N. Y., base bid **$1,725,000,** base bid 1A, **$1,690,000;** housing, Project Pa. 36295, from C. H. Martin, 513 Homewood Ave., Pittsburgh, and Hale Electric Co., 6218 Pennsylvania Ave., Pittsburgh, base bid **$863,360,** base bid 2 A, **$853,868.** CD 6/15—ENR 6/18.

†South Carolina — U. S. Eng., Greenville, June 23, miscellaneous bldgs., from Daniel Constr. Co., Greenville, and A. H. Guion Co., Kinney Bldg., Charlotte, N. C.

†South Carolina—U. S. Eng., Sumter, June 20, bldg. for low pressure chamber, from Avery Lumber Co., Sumter; bldgs., from Boyle Constr. Co., Sumter.



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PUBLIC BLDGS. (Continued)

†Texas—U. S. Eng., Federal Bldg., Galveston, bldgs., Proj. 4, from Bace-Marshall Const. Co., 4005 Center St., Houston, approx. **$386,000.** CD 6/18—ENR 6/25.

Wash., Seattle—Port of Seattle, Bell St. Terminal, June 24, 36 rein.-con. bins, 20 ft. diam., 85 ft. high, from Kuney-Johnson Co., 1716 E. 56 St. **$236,313.** CD 6/16.

†Wisconsin—Farm Security Admin., 901 N. 9 St., Milwaukee, June 22, bldg., preparation site, road, walks, utilities, from Ed. Kraemer & Son, Plain, Proposals **(1) $124,500 (2) $115,500.** CD 6/12.

CONTRACTS AWARDED

†Alabama—U. S. Eng., Bynum, central heating plant, to Perusini Constr. Co., Martin Bldg., Birmingham. Bids 6/22.

†Alabama—U. S. Eng., Courthouse, Mobile, bldg. addn., Inv. 569-42-743, to Smith-Pew Const. Co., 2117 Piedmont Rd. N.W., Atlanta, Ga. CD 6/26.

†Alabama—U. S. Eng., Courthouse, Mobile, bldg. addn., Inv. 569-42-743, to Smith-Pew Const. Co., 2117 Piedmont Rd. N.W., Atlanta, Ga. CD 6/28.

†Ariz., Kingman—Bureau Reclamation, Customhouse, Denver, Colo., 4 outdoor type transformers for Davis Dam project to Wagner Electric Co., 6400 Plymouth St., St. Louis, Mo. **$30,880.** Bids 5/6. CD 4/27—ENR 4/9.

★**†California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, bldgs., No. 510, to J. & B Constr. Co., 5572 Valley Blvd., Los Angeles. Est. over **$500,000.** Bids 6/20, awarded 6/22.

†California—U. S. Eng., 751 S. Figueroa St., Los Angeles, bldgs., No. 537, to R. E. McKee, 4700 San Fernando Rd. W., Los Angeles. Est. over **$150,000.** Bids 6/20, awarded 6/23.

★**†California**—U. E. Eng., 74 New Montgomery St., San Francisco, building and street paving, constructing railroad to Nielsen, Erbentraut & Summers, 446 6 St., San Francisco. Est. under **$2,000,000.**

★**†California**—U. S. Eng., 74 New Montgomery St., San Francisco, 17 grease racks, to V. H. Moore, 157 Lorimer St., Salinas, under **$1,000,000.** Awarded 6/25.

★**†California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, building, to Baruch Corp., 625 S. Olive St., Los Angeles. Est. over **$3,000,000.** CD 6/15—ENR 6/18.

★**†California**—Housing Auth. of City of Vallejo, Vallejo, housing, for NHA, to Barrett & Hilp, 918 Harrison St., San Francisco. CD 6/23—ENR 6/25.

★**†California**—Richmond Housing Auth., 271 10 St., Richmond, housing, to Moore & Roberts, 693 Mission St., San Francisco, and Carrico & Gautier, 365 Ocean Ave., San Francisco***housing, to C. R. Adams, 29 St. and Euclid Ave., Richmond, H. McLeod & R. F. Johnson & Son, 2036 San Pablo Ave., El Cerrito ***dormitory units to O. M. Rousseau, 321 Kearny St., San Francisco, for NHA. CD 6/23—ENR 6/25.

★**†California**—U. S. Eng., 74 New Montgomery St., San Francisco, bldgs., to D. W. Nicholson, 1701 San Leandro Blvd., San Leandro, and J. J. Moore Co., 354 Hobart St., Oakland, less than **$1,000,000.** Awarded 6/24.

★**†California**—U. S. Eng., 74 New Montgomery St., San Francisco, bldg. to A. J. Hendricks, Rt. 3, Box 295, Bakersfield, less than **$1,000,000.**

★**†California**—U. S. Eng., 74 New Montgomery St., San Francisco, bldgs., to J. C. Monk & Sons, 45 Tait Ave., San Jose, and Morrison W. Rees, 1262 Minnesota Ave., San Jose, less than **$1,000,000.** Awarded 6/24.

★**†Colorado**—U. S. Eng., Albuquerque, N. M., military housing to Hearn Constr. Co., Albuquerque, N. M.

★**†Colorado**—U. S. Eng., Denver, military housing, to Peter Scerie, 921 Detroit St., Denver, and Newstrom-Davis & Co., 2000 W. 8 St., Denver.

★**†Colo., Denver**—U. S. Eng., c/o Postmaster, Denver, bldg., to Newstrom-Davis & Co., 2000 W. 8 Ave., Denver. Est. less than **$1,000,000.**

★**†Connecticut**—Pub. Housing Auth., NHA, 24 School St., Boston, Mass., housing, Project, Conn. 6034, to J. Slotnik Co., 38 Newbury St., Boston, Mass., **$969,969.** CD 5/20—ENR 5/28, under LB.

★**†Florida**—U. S. Eng., Courthouse, Jacksonville, bldgs., Inv. 436-42, to Brady Roofing & Tile Mfg. Co., 3260 N.W. 27 Ave., Miami, less than **$1,000,000.** Awarded 6/18.

★**†Florida**—U. S. Eng., Courthouse & Postoffice, Jacksonville, bldgs. Inv. 436-42, to Moody Bros. Plumbing & Heating Co., Ft. Myers, less than **$1,000,000.** Awarded 6/20.

★**†Florida**—U. S. Eng., Courthouse & Postoffice, Jacksonville, bldgs., Inv. No. Neg. Jax. 42-52, to W. T. Sultenfuss, 803 James St., Tampa, less than **$1,000,000.** Awarded 6/16.

★**†Florida**—U. S. Eng., Courthouse & Postoffice, Jacksonville, bldgs., Inv. 436-42, to J. S. Wilson, Palm Beach, less than **$1,000,000.** Awarded 6/18.

★**†Georgia**—Pub. Housing Auth., NHA, Georgia Savings Bank, Peachtree and Broad Sts., Atlanta, housing, Projects Ga. 9043 and 9044, to Daniel Const. Co., Greenville, S. C. **$3,196,000.** Bids 6/22. Cletus W. Bergen & Asso., Liberty Bank & Trust Bldg., Savannah, archts. CD 6/8—ENR 6/11.

★**†Ga., Atlanta**—U. S. Eng., 494 Spring St. N.W., bldg. addn., to Hallman Bros., 725 Spring St. Less than **$1,000,000.**

†Illinois—Industrial Company, general contract plant, to Holm-Page Co., 2117 Kishwaukee St., Rockford. Defense Plant Corp. will finance. G. A. Johnson, Swedish-American Bldg., Rockford, archt.

★**†Illinois**—Industrial Company, plant, to Sumner S. Sollitt Co., 307 N. Michigan Ave., Chicago. Est. **$750,000.** Federally financed. CD 6/4—ENR 6/4.

★**†Illinois**—U. S. Eng., 300 Adams St., Springfield, bldgs., to Chell & Anderson, 176 W. Adams St., Chicago. Industrial Company will operate. Fugard, Olsen, Urbain & Neiler, 8 E. Huron St., Chicago, archts. CD 3/31—ENR 4/2, under CA.

†Illinois—Industrial Company, plant addn., to E. L. Lonergan Constr. Co., 203 N. Wabash St., Chicago***plumbing to M. Weil & Sons, 209 E. Superior St., Chicago***heating, to E. J. Claffey Co., 8 W. Illinois St., Chicago*** electrical work, to Savies Electric Co., 128 N. Jefferson St., Chicago. Est. about **$50,000.** Defense Plant Corp. will finance.

★**†Kansas**—U. S. Eng., 601 Davidson Bldg., Kansas City, Mo., military housing and water sys., facilities, to Tarlton & McDonald Constr. Co., 3615 Olive St., St. Louis, Mo. **$17,285,000.** CD 6/19—ENR 6/25.

★**†Maryland**—U. S. Eng., 1 and Douglas Sts., Wash., D. C., plant, to C. H. Tompkins Co., 907 16 St. N.W., Wash., D. C. Industrial Company will operate. Est. less than **$500,000.**

†Massachusetts—U. S. Eng., Park Square Bldg., Boston, bldgs., to Frankini Constr. Co., 30 Mystic Ave., Medford. Est. over **$150,000.** Bids 6/20.

†Massachusetts—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., bldg., to J. G. Roy & Sons Co., 21 Silver St., Springfield.

†Massachusetts—U. S. Eng., Park Sq. Bldg., Boston, military housing, to Frankini Constr. Co., 30 Mystic Ave., Medford. Bids 6/20.

★**†Mississippi** — U. S. Eng., Postoffice & Courthouse, Vicksburg, bldgs., utilities, roads, railroad facilities, storage, etc., to B. L. Knost, Pass Christian, **$1,088,000.** Est. $1,000,000. M. T. Morrissey, 709 Jackson St., Vicksburg, proj. engr. Awarded 6/3.

★**†Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, bldgs., to Olson, Assenmacher & Rokahr, 410 S. 7 St., Lincoln, **$629,437** and to Borchman & Gilmore Constr. Co., 4601 Dodge St., Omaha, **$749,384.** CD 5/6—ENR 5/14, under LB.

†New Jersey—Industrial Company, plant bldgs., to Hugh Montague & Son Co., 880 Bergen Ave., Jersey City, **$75,000.** Federally financed.

†New Jersey—U. S. Eng., 120 Wall St., New York, N. Y., bldg. alterations, addns., etc., to Censullo Burke Const. Co., 613-15 St., Union City. **$75,000.**

†New Jersey—U. S. Eng., Penn Mutual Bldg., Phila., Pa., bldgs., to W. Byrnes Bldg. Co., 430 Westfield Ave., Elizabeth. **$75,000.**

†New Jersey—U. S. Eng., Penn Mutual Bldg., bldgs., alterations, addns., bldgs., to S. J. Day Assocs., 601 Mattison Ave., Asbury Park, **$250,000.**

★**†New Jersey**—U. S. Eng., Penn Mutual Bldg., Phila., Pa., military housing, to Slonk Const. Co., 32 Decker Ave., Elizabeth.

★**†New York**—Industrial Company, plant, to James Stewart & Co., Inc., 65 Bway., New York. **$750,000.** Defense Plant Corp. will finance. CD 6/19—ENR 6/25.

★**†North Carolina**—U. S. Eng., Arcade Bldg., Asheville, bldgs., to Robinson Bros. Contractors, Inc., Asheville. Bids 6/24. CD 6/23—ENR 6/25, under CA.

†North Carolina—U. S. Eng., 308 Customhouse, Wilmington, bldgs., to P. S. West Constr. Co., Statesville. Bids 6/20.

†North Carolina—U. S. Eng., Ft. Bragg, bldg., to P. S. West Constr. Co., Statesville. Bids 6/18.

†North Carolina—U. S. Eng., 308 Custom house, Wilmington, bldgs., utilities, to P. S. West Constr. Co., Statesville, grading, paving, etc., to R. H. Wright, Atlanta, Ga., and McDougald Constr. Co., Northside Dr. N.W., Atlanta, Ga. Bids 6/22.

★**†Ohio**—Pub. Housing Auth., NHA, 201 N. Wells St., Chicago, Ill., housing, Project, OH 33049, to Hunkin-Conkey Const. Co., 1740 E. 12 St., Cleveland. Est. **$7,400,000.** CD 5/27.

★**†Oklahoma**—U. S. Eng., Citizens Bank Bldg., Denison, Tex., general contract bldgs., to Knutson Constr. Co., Union Natl. Bank Bldg., Houston, Tex., approx. **$3,200,000. (Correction**—contractor.) CD 6/15—ENR 6/18 under CA.

†Rhode Island—U. S. Eng., Industrial Trust Bldg., Providence, bldg., to Dimeo Constr. Co., 75 Westminster St., Providence. Bids 6/24.

†South Carolina—U. S. Eng., Lexington, bldgs., electrical facilities, to J. C. Heslep Co., Columbia *** water sys., to C. Y. Thomason Co., Greenwood***piling, to E. C. Bridges, Heath Springs. CD 6/16.

★**†Tennessee**—Caine Steel Co., tral St., Chicago, Ill., plant str. Co., 1467 Lamar Ave., M **$1,000,000** cost plus. Federally B. Spencer, 1st Natl. Bank archt. CD 4/30—ENR 5/7, un Bldgs.

†Texas—U. S. Eng., Fort bldg. addn., Spec. 42-90, to G Builders Exch. Bldg., San An Bids 6/13. CD 6/9.

†Texas—U. S. Eng., Fort bldg. expansion, to Truehart, Ca Builders Exch., San Antonio, ap CD 6/4—ENR 5/28.

★**†Texas**—Industrial Company, tract plant, to Austin Bridge Moore, 1813 Clarence St., Dallas Total est. $14,850,000. Defense will finance. CD 5/28—ENR 6/4

†Texas—Texas Electric Steel Bringhurst and Gillespie Sts., H for War Dpt., to Andrew Ness Garden Villas. **$92,000.**

†Texas—U. S. Eng., Masonic rillo, bldgs., Apl. 153, force accou

†Texas—U. S. Eng., Camp W utilities, Inv. W2161-42-55, to A Guaranty Bldg., Galveston, **$14,500** —ENR 6/25.

†Texas—U. S. Eng., Fort San building, railway spur tracks, S to Wm. A. Smith Const. Co., Inc., & Grace, 301 Gregg St., Houston asphalt roads, concrete sidewalks Mack, Jr., Nixon Bldg., Corpus **000.**

†Texas—U. S. Eng., Cotton Dallas, bldgs., to Cedric Burgher 3027 Main St., Dallas, **$260,000.**

★**†Virginia**—Yards & Docks, Navy St. and Constitution Ave. N.W. D. C., additional bldgs., Agreement 1 NOY 4375, to Wise Co., Inc., 122 North 8 St., Richmond, engrg. Engr. Co., Nelson Bldg., Newport **$4,832,500.** Awarded 6/12. Additional 5/9/41—ENR 5/15/41, under CA.

†Washington—Industrial Company, General Constr. Co., 3840 Iowa Ave., Est. **$75,000.** Federally financed.

†Wisconsin—U. S. Eng., 408 Federal Milwaukee, plumbing for bldgs., to Welch Co., Madison.

†Wisconsin — Industrial Company, addn., to Austin Co., 510 N. Dearborn Chicago, Ill. Defense Plant Corp. will

†Pacific Northwest—U. S. Eng., Tower, Seattle, Wash., warehouse, to Valle Co., 407 3 Ave. W., Seattle, Wash.

†Pacific Northwest—U. S. Eng., Tower, Seattle, Wash., sanitary bldg., to Eckart Bros., 2218 2 Ave., Wash.

†Pacific Northwest—U. S. Eng., Tower, Seattle, Wash., bldgs., to Peterson, 4517 California Ave., Seattle, bldgs., to Nettleton Lumber Co., 26 Ave. and W. Florida St., Seattle, Wash. —ENR 6/18.

★**B. C., Vancouver**—Dpt. National for Air, Ottawa, Ont., accommodation E. F. T. School, to Dominion Const. Co., 509 Richards St. **$616,000.** Awarded 6/24.

Ont., Camp Borden—Dominion tawa, repair and work shop, to W. Ltd., 30 W. Bloor St., Toronto, **$50,000.** Natl. Defense, Ottawa, archts. Dpt. & Supply, Ottawa, engrs.

★**Ont., Cornwall**—Dpt. Munitions & Ottawa, plant, Stormont Works, Hy., to Carter-Halls-Aldinger Co., Ltd., Cherry St., Toronto, about **$2,000,000** CD 6/3—ENR 6/18.

Que., Longueuil—Dpt. Natl. Defense, Ont., artillery proof bldgs., to Const. Co., Ltd., 1440 St. Catherine St. Montreal, about **$300,000.**

★**Ont., Orillia**—Secy. Dpt. Munitions & ply, Ottawa, 31 camp bldgs. at head Patrick St., for C. A. (B) training to W. C. Brennan Contg. Co., Ltd., Ave. N., Hamilton. About **$700,000.** Bids CD 6/3.

★**Ont., Sarnia**—Dominion Govt., Ottawa, vanced infantry training center, to son Bros., Ltd., Brantford, **$550,000.**

★**Que., Bouchard**—Dominion Govt., Ottawa, Ont., munition plant, to Angus Robertson Ltd., 660 Ste. Catherine St. W., Montreal, **$2,000,000.** Dpt. Munitions & Supply, Ottawa, Ont., engrs.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., San Diego—A. Simons, c/o L. L. Jones, archt., 1548 W. 7 St., Los Angeles, frame and stucco or siding dwellings, Manor Tract. Over $150,000.

Conn., Bridgeport—Park Pequonnock Corp., James and Chestnut Sts., sketches 13 apartment bldgs., brick, Lexington Ave., James and Chestnut Sts. Over $150,000.

COMMERCIAL BLDGS. (Proposed Work, Cont'd.)

Miss., Columbus—A. Dlugaen, 14 N. 2 St., Memphis, Tenn., plans by W. C. Lester, Dermon Bldg., Memphis, Tenn., residences, $150,000.

N. J., Lyndhurst—B. Sagel, 14 Maple Ave., Hackensack, plans by P. S. Simon, 210 Main St., Hackensack, group 2½ story, bsmnt., frame, brick 2 family homes, Fern Ave. $150,000.

N. J., Perth Amboy—Savoy Homes, Inc., 215 E. 23 St., New York, N. Y., plans by Schmidlin & McMurray, 982 Stuyvesant Ave., Union, eighty-five 1½ story, bsmnt. homes, Wagner Ave. $425,000.

★**N. J., Rahway**—Stanley Homes, Inc., 3422 Ave. T, Brooklyn, N. Y., plans by O. I. Silverstone, 153 Pierrepont St., Brooklyn, N. Y., one hundred fifty 1½ and 2 story, bsmnt., brick homes, Linden Ave. $750,000.

★**O., Cleveland**—Co-operative Engineers; J. Riga, in charge, 13811 Byron Ave., 200 homes. $1,000,000. G. J. Stipek, 3441 Lee Rd., designer.

★**O., Cleveland**—M. Helper & Son Co., 719 National City Bldg., 90 homes. $540,000.

Pa., Chestnut Hill (P. O. Phila.)—J. A. Hayden, 838 E. Haines St., Phila., housing, Chesney Downs, Springfield Twp., Montgomery Co., near here. Over $150,000.

★**Wash., Seattle**—P. Keller-Block, 4841 E. 43 St., 279 houses, W. Roxbury St. and 30 Ave. S.W. $800,000. Morford & Mowry, Lyon Bldg., engrs.

Wis., Baraboo — John M. Kelley, Baraboo, houses.

LOW BIDDERS

Md., Cheltenham—Cheltenham School for Boys, Cheltenham, 2 story, brick dormitory, from Morrison Bros., Bethesda, Kea, Ross & Walton, Hyattsville, archts.

CONTRACTS AWARDED

Calif., Berkeley—James L. Rich, 211 Trinity Rd., 24 unit home project. Owner builds. Over **$150,000.** CD 6/8—ENR 6/18.

Calif., Inglewood—L. A. Extension Co., 647 S. Spring St., Los Angeles, 105 five room dwellings, 20 acre site, near Rogers and de Haviland Sts., to Marlow-Burns Development Co., 5360 Angeles Vista Blvd., Los Angeles, over **$150,000.**

★**Calif., Pittsburg**—California Homes, Inc., 1 Drumm St., San Francisco, 624 homes. Owner builds. **$3,000,000.** CD 6/8—ENR 6/11.

★**Calif., Pittsburg**—Clyde O. Sweet Development Co., 5253 College Ave., Oakland, homes, to V. W. Pacini, 436 Railroad Ave., Angelo Davi, 771 Central Ave., and R. Cataline, 1075 Cumberland, all of Pittsburg. Est. **$1,000,000.** CD 6/8—ENR 6/11.

Calif., Vallejo — J. Jansen, 3833 Franklin Blvd., Sacramento, 50 homes. **$150,000.** Owner builds. CD 7/17—ENR 7/24.

★**Calif., Vallejo**—Newbridge Park Realty Co., 1182 Market St., San Francisco, 250 residences north of Sulphur Springs Rd. Owner builds under name of Bellehaven Realty Co., 1182 Market St., San Francisco. Est. **$1,125,000.**

Conn., Bridgeport — Huntington Holding Corp., Huntington Turnpike, frame homes, Tully Circle. Owner builds. **$150,000.**

Conn., Bridgeport—Jennings Hills, Inc., 670 Huntington Turnpike, homes, Jennings Ave. Owner builds. **$250,000.**

Conn., Norwalk—Reynolds Brothers, Inc., 68 Park Ave., Danbury, 50 homes George Ave. at Westport Ave., incl. sewers, etc. Owner builds. **$200,000.** CD 5/14—ENR 5/28.

Conn., Stamford—J. G. Hollerith, Cathlow Dr., Riverside, 18 two family frame homes, Summer St., to Neale Kelley, Riverside St., Old Greenwich. Est. **$150,000.**

Ga., Marietta—Victory Homes of Marietta, Inc., c/o F. S. Wilson, Marietta, 100 frame, brick homes, to Wilson & Henderson, Miami, Fla.

Me., South Eliot—Parent Homes, Inc., Parent St., South Berwick, 35 frame homes. Owner builds. **$150,000.** Ames & Sheehan, 79 High St., Somersworth, N. H., archts. CD 6/23.

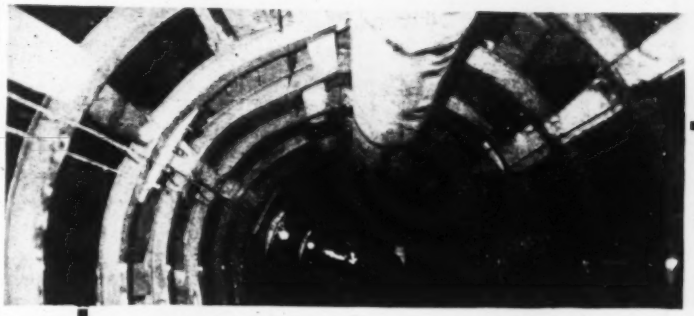
Me., South Portland (br. Portland)—Parent Homes, Inc., Parent St., South Berwick, 45 homes. Owner builds. **$175,400.** Ames & Sheehan, 79 High St., Somersworth, N. H., archts. CD 6/23—ENR 6/25.

Md., Baltimore—Oaklee Village, Inc., c/o J. E. Moxley, archt., 1722 Ellamont St., 6 two story, apartment house units, Bensinger Rd., and 6 two story, brick, apartments, concrete fdns., Leeds and Colchester Aves., to Property Sales Co., Munsey Bldg. Est. **$150,000.**

Md., Bladensburg—Hilltop Manor, Inc., Bethesda, six 2 and 3 story, brick apartments to Morrison Bros., Bethesda. Ross & Walton, Hyattsville, archts.

Md., Chillum (mail Hyattsville)—Phillip Lustine & Perry Boswell Hyattsville, 20 apartments, (180 units) 2 and 3 story, brick, to Morrison Bros., Bethesda. Ross & Walton, Hyattsville, archts.

Md., Hyattsville—Harry Yates Boswell, Hyattsville, four 2 and 3 story, brick, apartments, to Morrison Bros., Bethesda. Ross & Walton, Hyattsville, archts.



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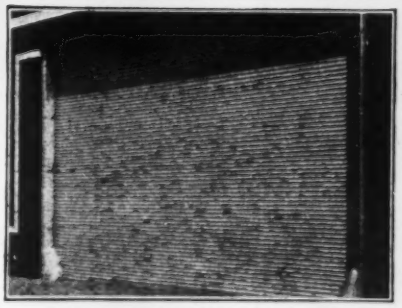

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COMMERCIAL BLDGS. (Contracts Awarded, Cont'd.)

Md., Rockville—Miller Development Co., 1119-17 St. N.W., Wash., D. C., 100 one and two story, brick veneer residences, Mass. Ave, Exten., near here. **$300,000.** Owner builds. G. E. MacNeil, 1119-17 St. N.W., Wash., D. C., archt.

★ **Md., Silver Spring**—Parkway Builders, 1010 Vermont Ave. N.W., Wash., D. C., one hundred thirty-eight 2 story, brick veneer residences, to David Milestone, 1010 Vermont Ave. N.W., Wash., D. C. Est. **$500,000.**

Md., Silver Spring—Millers, Inc., c/o J. T. Thomen, archt., 1410 H St. N.W., Wash., D. C. seven 2 story, brick apartments, to Standard Constr. Co., 415 5 St. N.W., Wash., D. C. CD 3 3—ENR 3/5.

Md., Suitland—Suitland Manor Corp., 1713 K St. N.W., Wash., D. C., 54 flats, 2 story, brick; group eight 1 story, bsmnt. stores for shopping center. **$150,000.** Owner builds. E. Weihe, 927 15 St. N.W., Wash., D. C., archt.

Md., Takoma Park (sta. Wash., D. C.,)—Owner, c/o Ross & Walton, archts., Hyattsville, five 2 and 3 story, brick, apartments, to Davis & Platt, Inc., Silver Spring.

Mich., Highland Park (br. Detroit)—Highland Park Osteopathic Hospital, Highland Park, brick, steel, rein.-con., stone hospital addn. to W. E. Wood Co., 4649 Humboldt Ave., Detroit. Est. **$160,000.** Bennett & Straight, Michigan Ave., Dearborn, archts.

★ **Neb., Fremont**—Richard Court, Inc., 1 St. and 5 Ave., 96 houses. Owner builds. **$700,000.** S. A. Solheim, 220 Sharp Bldg., Lincoln, archt.

N. H., Somersworth—Parent Homes, Inc., Parent St., South Berwick, Me., 100 homes, owner builds***heating, plumbing, to Palmer Plbg. Supply Co., 100 S. Main St., Rochester*** electrical work, to R. Pill Electric Co., 95 Sanford St., Boston, Mass. Est. **$450,000.** Ames & Sheehan, 79 High St., archts. CD 6/24.

N. J., Bayonne—Harborside Homes, Inc., c/o B. Sumner Gruzen, archt., 921 Bergen Ave., Jersey City, fifty 2 story, bsmnt., frame, brick homes, Bway., separate contracts. **$350,000.** CD 5/21—ENR 5/28.

N. J., Bayonne—Harmony Homes, Inc., 12 E. 41 St., New York, N. Y., thirty-seven 2 story, bsmnt., brick homes, E. 1 St., separate contracts. **$185,000.** CD 6/9—ENR 6/11.

N. J. Clifton—Lovel Bldg. Co., 713 Ogden Ave., Teaneck, twenty-five 2½ story, bsmnt., 38x49 ft., frame, brick veneer apartment houses, Godfrey Pond. Separate contracts. **$250,000.** P. S. Simon, 210 Main St., Hackensack, archt. CD 5/12—ENR 5/14.

N. J., East Brunswick (mail New Brunswick)—Brunswick-Jordan Estates, c/o J. B. Weiss, 166 Court St., Brooklyn, N. Y., sixty 1½ story, bsmnt., brick veneer and cement block homes, Northern Dr., separate contracts. **$300,000.** M. E. Ungarleider, 66 Court St., Brooklyn, N. Y., archt. CD 6/11—ENR 6/18.

N. J., Raritan—Runyon Park, Inc., Lehman Ave., Deal, one hundred 1½ story, asbestos siding homes, MacArthur Dr., separate contracts. **$300,000.**

INDUSTRIAL BUILDINGS

PROPOSED WORK

Calif., Melones — MILL — Carson Hill Gold Mining Corp., Melones, stamping and ball mill, near Angeles Camp, near here. **$400,000.**

Conn., Brideport — FACTORY — Fletcher Thompson, Inc., 1336 Fairfield Ave., soon lets contract structural steel for 2 story, brick, steel factory Walter and E. Main Sts., for Bridgeport Brass Co., H. W. Strinkrauss, genl. mgr. $250,000. Bids 2 weeks for fdn., 3 weeks for general contract. CD 4/21—ENR 4/23.

Ia., Clinton—PLANT—Clinton Products Co., W. F. Powers, pres., alcohol plant. $50,000.

★ **La., Dubuque** — FACTORY — Iowa Egg Products Co., Dubuque, rebuilding 2 factory bldgs., destroyed by fire. $500,000.

La., New Orleans—PLANT—Albert Kahn Associate Architects & Engineers, Inc., 345 New Center Bldg., Detroit, Mich., soon lets contract plant.

Md., Fairfield, (Sta. Baltimore)—SERVICE, etc.—Industrial Co. soon lets contract, three 1 story, cinder block service bldgs., concrete fdns. also 2 story frame office addn. $75,000. J. E. Greiner Co., 1201 St. Paul St., Baltimore, archt. and engr.

Mass., Dorchester (sta. Boston) — WAREHOUSE — George Lawley & Son Corp., 26 Ericsson St., completing plans by C. L. Hibbard, 49 Walnut St., Milton, 2 story, 80x156 ft., brick warehouse, Lawley St.

Mass., Quincy — PLANT — Bethlehem Steel Co., E. Howard St., soon lets contract brick pipe plant. $40,000.

Minn., Rushford and **Lanesboro**—POWER PLANT—Dairyland Power Co-operative, Arcadia, Wis., imprv., enlarging power plant, Rushford and Lanesboro. $45,000.

Minn., St. Paul—ICE PLANT—Certified Ice & Fuel Co., E. A. Faltesek, mgr., Fairfield Ave. and Bell St., rebuilding ice plant, destroyed by fire. $40,000.

N. J., Irvington—MACHINE SHOP—General Tool & Mfg. Co., 196 Colt St., soon lets contract, 1 story, irregular sized machine shop, Colt St. P. Mertens, 103 Osborne Terrace, Newark, archt.

N. J., Newark — GARAGE — Feigenspan Brewing Co., 50 Freeman St., 1 story, 200x300 ft., brick, concrete block garage, on piers, Brill St. $90,000. W. E. Lehman, 972 Broad St., archt.

O., Cleveland—FACTORY—Modern Tool & Die Co., J. Mall, pres., 5389 Settlement Rd., brick, steel factory addn. $100,000.

★ **Pennsylvania**—PLANT — Carnegie Illinois Steel Co., B. J. Reif, purch. agt., Carnegie Bldg., Pittsburgh, made plans plant bldg. $100,000-$500,000.

Pennsylvania — FOUNDRY — Federal Fdry. Supply Co., L. N. Heyl, vice pres. and genl. mgr., 4600 E. 71 St., Cleveland, O., plans by H. M. Morse Co., 1500 Superior Ave., Cleveland, O., 1 story, brick foundry. $40,000.

Pa., Pittsburgh—PLANT—Jones & Laughlin Steel Co., F. W. Ochsenhirt, purch. agt., J and L Bldg., sketches 1 story, steel plant exten. $100,000.

Tex., Borger—PLANT—Phillips Petroleum Co., Borger, storage facilities. $80,000.

Tex., Edinburg—PLANT—Central Power & Light Co., 215 E. Harriman St., 1 story, brick, rein.-con. ice mfg. unit. About $40,000.

★ **Utah, Lehi**—PLANT—Emsco Corp., South Gate, Los Angeles, Calif., soon lets contract, silica brick plant, $700,000. Holmes & Narver, 639 S. Spring St., Los Angeles, Calif., engrs.

Wash., Tacoma—SAWMILL—Henry Mill & Timber Co., 3001 N. Starr St., rebuilding saw mill. $40,000.

W. Va., Spencer—PLANT—Owner, c/o Dr. A. L. Casto, Spencer, plant.

★ **Ont., Kapuskasing**—PLANT—Spruce Falls Power & Paper Co., Ltd., Kapuskasing, completion pulp and paper plant. $575,000.

★ **Ont., Merritton**—PLANT—A. E. Nicholson, archt., 46 Queen St., St. Catherines, bids soon, plant addn., for Hayes Steel Products, Ltd., Merritton. $622,000 equipped.

BIDS ASKED

Bids Asked After June 30

Mass., Lawrence — PLANT — Victory Steel Products Co., Market and Foster Sts., 1 story, 80x265 ft. plant addn. and repairing, altering old structure. Over $40,000. Ashton & Huntress, 414 Essex St., archts. CD 6/15—ENR 6/18.

Bids Asked

Mass., Lynn—PLANT—General Electric Co., 920 Western Ave., Lynn, plant, No. 64-7. Over $40,000.

LOW BIDDERS

★ **Ala., Prichard**—MILL—J. C. Sanders Cotton Mill Co., J. C. Sanders, pres., June 25, mill, from G. H. Bonle & Howard Cuthrell Co., Homewood. Est. **$750,000.** H. Pembleton, 2121 Highland Ave., Birmingham, archt.

CONTRACTS AWARDED

★ **Ala., Gorgas** — STEAM GENERATOR PLANT—Alabama Power Co., 600 N. 18 St., Birmingham, superstructure for steam generator plant (60,000 kw. unit) to Wilborn Constr. Co., 830 2 Ave. N., Birmingham; plumbing, to G. A. Crook Plumbing & Heating Co., 517 55 Pl., S., Birmingham. Est. **$6,000,000.** Bids 5/15. CD 5/25—ENR 5/28.

Calif., Fontana—WAREHOUSE—Industrial Company warehouse, to B. K. Tanner, 441 N. Beverly Dr., Beverly Hills, **$150,000.** Bids 6/15. CD 6/10—ENR 6/18.

Calif., Huntington Park—FACTORY—Pacific Fabricating Co., 1911 E. 51 St. Vernon, factory, E. Gage Ave. at Salt Lake Ave., to E. S. McKittrick Co., 7839 Santa Fe Ave., Los Angeles. Over **$40,000.**

Calif., Lynwood — PLANT — Western Gear Wks., Alameda St. and Imperial Hy., 80x240 ft. brick assembly bldg., 24x109 ft. concrete service bldg., 2 story, 40x106 ft. frame personnel bldg., to Modern Builders Constr. Co., 2812 Long Beach Blvd., Long Beach. Est. over **$40,000.** J. H. Davies, Ocean Center Bldg., Long Beach, engr.

Calif., Santa Clara — PLANT — Rosenberg Bros. & Co., Railroad Ave., Santa Clara, 1 story, 200x300 ft. fruit packing plant addn., to Pasetta Constr. Co., 2390 Park Ave. **$80,000.**

★ **Connecticut**—FACTORY—Industrial Company brick, steel concrete mfg. unit, School St., to Bartlett-Brainard Co., 103 Woodbine St., Hartford. Est. **$1,000,000.** CD 6/19—ENR 6/25.

Conn., West Haven (br. New Haven)—PLANT—Bridgeport Grinding Machine Co., Inc., 60 1 Ave., 2 story, 42x112 ft., brick plant, to Joseph N. Rice, Inc., 60 Peck St., New Haven. CD 6/9—ENR 6/11.

Ill., Chicago—FACTORY—American Phenolic Corp., 1830 S. 54 St., Cicero, 100x266 ft. top addn., alterations, warehouse, 1 story, 80x310 ft. warehouse, concrete corrugated asbestos sidings, to Campbell-Lowrie-Lautermilch Corp., 400 W. Madison St., Est. over $100,000. Bids 6/22, awarded 6/26. Burnham & Hammond, 160 N. La Salle St., archt.

Ia., Cherokee—SHOPS—Illinois Central System, C. H. Mottier, ch. engr., 135 E. 11 Pl., Chicago, Ill., repairing, imprv. railroad shop bldgs., to Zitterell Mills Co., Webster City, **$50,000.**

Ia., Clinton — PLANT — Gatew... Co., Clinton, general contract plan... Eng. Co., Clinton, **$150,000.**

Md., Baltimore—INSPECTION—... Brush and Hamburg Sts., 1 story, inspection bldg., to Morrow Bros. Eager St. Est. **$45,000.**

Md., Chillum (mail Hyattsville) ... Washington Gas Light Co., 410 ... Wash., D. C., brick, concrete plant ... forces. G. D. Mock 411 10 St. N. ... D. C., engr.

Mich., Detroit—FACTORY—Cog... Drill Co., 6511 Epworth Blvd., 1 st... ft., brick, rein.-con., steel factory, ... to Talbot & Meier, 1000 Larch... Est. **$75,000.** P. Sewell, 324 McKer... Detroit, archt.

Minn., Minneapolis — FACTORY ... apolis-Honeywell Regulator Co., 2... S., general contract remodeling ... Naugle-Leek, Inc., 522 Roanoke Bldg. —ENR 5/31.

N. J., Jersey City—GENERATOR STATION —Pub. Serv. Electric & Gas Co., 80 ... Newark, altering 50x63x60 ft., brick, ... erator station, boiler and blower room addn., Duffield Ave., to Becker Constr. Co., 361 Grote St., Newark. **$90,000.**

N. J., Newark—REFINERY—American Aviation Oil Co., 225 Bway., New York, N. Y. reconstructing oil refinery bldgs., etc., separate contracts. **$100,000.** W. Ormont, 225 Bway., New York, N. Y., engr.

N. J., Newark—PLANT—Couse Laboratories, Inc., 300 Passaic Ave., 2 story, bsmnt., 110x240 ft., brick plant, Passaic Ave. to Edward M. Waldron, Inc., 40 Park Pl., **$250,000.**

Pa., Blairsville—FACTORY — Porter-Blairsville Co., Div. H. K. Porter Co., P. O. Box 168, 2 factory bldgs., alterations, separate contracts. Over **$60,000.** F. Andre, 49 St. and Harrison Ave., Pittsburgh, constr. engr.

Pa., Millvale — FACTORY — E. T. Lippert Saw Co., E. B. W. Pfishner, pres., 608 Lincoln Ave., 1 story, 90x90 ft., brick, steel factory, Lincoln Ave., to F. F. Pschirer, 653 North Ave.

R. I., Woonsocket — BOILER PLANT — Woonsocket Rayon Co., Clinton St., 45x50 ft. brick boiler plant, 50 ft. high, to Brien Bldg. Co., Inc., 126 Clinton St. Est. **$40,000.** Bids 6/19. CD 6/18—ENR 6/25.

Tex., Houston—PLANT—W. Ruska Co., Inc., 2332 Bellaire Blvd., 3 story plant, to Benson-Marxen Co., c/o owners, **$70,000.** CD 12/29—ENR 1/11.

Wis., Green Bay—WAREHOUSE—A Rosenberg's Sons, 525 N. Jefferson St., 1 story, 60x125 ft. metal siding on frame warehouse, concrete fnd., to Selmer Co., Northern Bldg. H. W. Williams, Northern Bldg., archt.

Wis., Lake (Milwaukee P. O.)—PLANT—Screw Machine Products Co., 4051 S. Iowa St., masonry, concrete and excav. work, 1 story, part bsmnt., 80x130 ft. and 20x92 ft. concrete block plant addn., rein.-con. fdn., to Frank Stelzl & Sons, Inc., 3068 N. 24 Pl., Milwaukee***carpentry work to T. Simons, 2116 E. Howard Ave., Milwaukee***plumbing, heating, to Paul J. Grunau Co., 2697 S. Kinnickinnic Ave., Milwaukee. M. F. Pfaller, 8525 Ravenswood Circle, Wauwatosa, archt.

Wis., Milwaukee — FACTORY — Milwaukee Tool & Die Co., 4040 N. 34 St., concrete and masonry work for 1 and 2 story, 75x120 ft. steel, brick factory, concrete fdn., to Ray Stadler, 2617 N. 90 St.***structural steel to C. Hennecke Co., 3225 N. Pierce St.***heating, to L. J. Mueller Furnace Co., 2005 W. Oklahoma Ave. CD 4/28—ENR 4/30.

Wis., Milwaukee—MACHINE SHOP—Doelger & Kirsten, Inc., 3015 W. Chambers St., 1 story, 30x195 ft., brick, concrete machine shop addn., to Meredith Bros., 121 E. Washington St. Est. **$40,000.** Bids 6/16. A. H. Bauer, 606 W. Wisconsin Ave., archt.

Wis., Sturgeon Bay—WAREHOUSE—Fruit Growers Assn., Sturgeon Bay, general contract 2 story, 75x83 ft., frame warehouse, concrete fdn., to Ed. B. Olson Constr. Co., Sturgeon Bay. S. Schmitt, Two Rivers, archt.

Man., Winnipeg—FOUNDRY — Vulcan Iron Wks., Ltd., 7 Maple Ave., foundry addn., etc., to Winnipeg S & F Co. Ltd., 812 Boyd Bldg. Est. **$40,000.**

Ont., Larder Lake—SMELTING PLANT—Sanymac Mining & Development Co., Ltd., Kirkland Lake, smelting plant, day labor. **$50,000.**

★ **Ont., Toronto**—PLANT—Dow Chemical Co. of Canada, Ltd., 159 Bay St., plants, 5-bldg. section to Anglin-Norcross, Ontario, Ltd., 57 Bloor St. W., Toronto, and 1-bldg. section, to Pigott Const. Co., Ltd., Pigott Bldg., Hamilton, about **$1,000,000.**

Ont., Toronto — PLANT — Parker Fountain Pen Co., Ltd., 154 University Ave., plant exten., to R. G. Kirby & Sons, Ltd., 530 Yonge St. **$63,500.** E. A. Cross, 991 Bay

Que., Montreal—PLANT—Canada Strip Mill Co., Ltd., plant, to Carter-Halls-Aldinger Co., Ltd., 419 Cherry St., Toronto, Ont., about **$350,000.**

Que., Shawinigan Falls—PLANT—Canadian Carborandum Co., Ltd., Transmission St., plant addns., to J. F. Wickenden, Bank of Montreal Bldg., Three Rivers, about **$243,000.**

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